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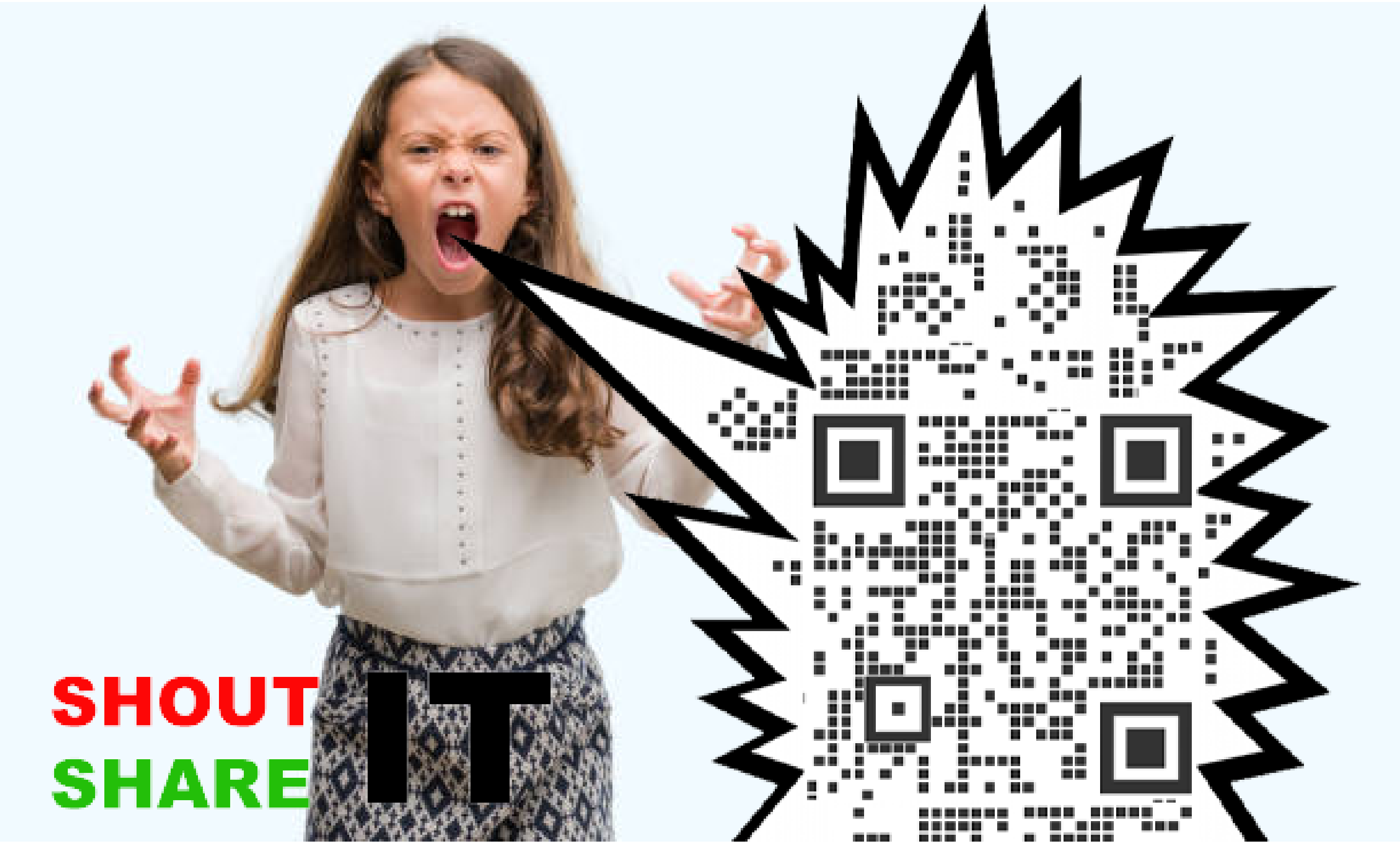
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A STUDY OF THE TEIID LIZARDS OF THE GENUS CNEMIDOPHORUS WITH SPECIAL REFERENCE TO THEIR PHYLOGENETIC RELATIONSHIPS

BY

CHARLES E. BURT
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The present work forms No. 154, of the *Bulletin* series.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., March 17, 1931.

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A STUDY OF THE TEIID LIZARDS OF THE GENUS CNEMIDOPHORUS, WITH SPECIAL REFERENCE TO THEIR PHYLOGENETIC RELATIONSHIPS

By Charles E. Burt

Of Trinity University, Waxahachie, Texas

INTRODUCTION

The genus *Cnemidophorus*, one of the largest and most important units within the family Teiidae, is a complex assemblage of species, subspecies and phases, which reaches its maximum diversity in North America. The forms here assigned to this genus occur from southern Brazil to the northern United States, both on the mainland and on the closer neighboring islands, thus comprising one of the most widespread and characteristic groups of lizards of the New World.

Within the remarkably narrow generic limits of *Cnemidophorus*, an amazing amount of variation is seen. Its unusually extensive distribution brings it into contact with a great variety of habitat conditions to which its forms seem to be constantly adapting themselves through their apparently natural tendency to vary. Moreover, in many of the species each individual shows an intricate series of pattern stages during development, and abnormalities are frequently found in the various populations. Many of the supposed species have been described from only a few specimens, often wholly without regard to the geographical probabilities, and frequently without reasonable allowances for the normal developmental and environmental pattern variation. Furthermore, the genus itself has never been clearly defined and it is found that some of its oldest species should have been referred to the very closely related genus *Ameiva*. In the absence of a comprehensive review of the genus *Cnemidophorus* it is not surprising that there has always been much uncertainty as to the number of forms, their relationships, distribution, and differentiation, one from another.

The present study has been undertaken to bring order into this perplexing group of lizards, and to discover the origin and relationships of the component forms. It is hoped that this revision will stimulate interest in the various lizards of the genus *Cnemidophorus*, that it will show from what localities specimens are needed, and that above all it will emphasize the lack of knowledge of habitat and habits.

The need for this work has been evident for a considerable length of time. Cope (1900), after a lifetime of study, wrote that "the discrimination of the North American species of this genus is the most difficult problem in our herpetology." Prior to this a foreign viewpoint was expressed by Günther (1885), who elaborated his discussion of *Cnemidophorus sexlineatus* by the following comment: "Bocourt included in the synonymy of this species a number of other names which have been created by American authors on very slight grounds. I fully agree with him as to their value, but it is difficult to determine to which species they should be referred. From the character of the descriptions and figures I regard this task as impossible."

The opinion of Gadow (1906) is well expressed by the following extracts from his work on the Mexican species of *Cnemidophorus*: "This Teiid genus is invaluable for the study of variation. It is so plastic * * * that it is represented by some form in almost every kind of terrain." * * * "Most of the 'species' are so variable that they may well drive the systematist to despair. No two authorities will, nor can, possibly agree on the number of admissible species * * * (for) * * * almost every one of the taxonomic characters investigated in this paper has an amplitude of variation within some species which equals that of the whole genus."

Much the same idea was expressed by Ditmars (1907) in prefacing his treatment of the genus *Cnemidophorus*, thus—"In the preparation of a resumé of the species of *Cnemidophorous*, the writer finds himself confronted by the most difficult proposition of any yet encountered in this work. Provided with a fine set of specimens, he has attacked this obstacle from every side—and with very little success * * * Nothing can straighten out this problem but the work of some one who makes a specialty of the genus, gathers about him elaborate series of all of the species and notes his observations impartially."

It is noteworthy that Camp (1916*b*), in reporting on a collection from California, cited *Cnemidophorus* as a "remarkably unstable genus," and that Schmidt (1922), in his consideration of the herpetological fauna of Lower California, wrote that "An adequate understanding of the relations of the 15 species of *Cnemidophorus* in the present list can only be reached by the comprehensive study of a large series of each species."

Strecker (1928*b*), after much field experience, has recently expressed the view that "all of the lizards of the genus *Cnemidophorus* are exceedingly variable and sometimes the same species differs greatly in color according to the locality in which it is found."

During the progress of this study it has become apparent that the problem of bringing order into the existing taxonomic confusion of *Cnemidophorus* is not as hopeless as many have supposed. A surprisingly large amount of material has accumulated in museums—much of this the result of recent collecting. Therefore, very large series of most of the species and subspecies have been available. The situation met has been so strikingly similar to that expressed by Prof. Asa Gray (1863) in reviewing the revision of the oaks (genus *Quercus*) by the famous botanist, De Candolle, that one must regard his words as being fully as applicable to animals as to plants. It was found that "Where specimens were few, as from countries little explored, the work was easy, but the conclusions of small value. The fewer the materials, the smaller the likelihood of forms intermediate between any two * * * Where, however, specimens abound * * * here alone were data fit to draw conclusions from."

It is believed that the present study brings the understanding of the genus *Cnemidophorus* up to date. However, as new series of specimens become available, and additional geographical localities come to be represented, modifications of the ideas of relationships here expressed, and readjustments of the ranges, are inevitable. The writer has been forced to link many forms as sub-species, and, as must have been expected, a reduction in the number of forms recognized, rather than an increase, has been necessary. In fact no new species have been found. It is true that nothing can be gained by the "lumping" of doubtful forms, but, on the other hand, much confusion results from the retention of indefinable species and subspecies in the hope that future collections will prove them to be distinct. Certain differences in this genus, such as melanism or the type of mesoptychial scutellation, seem to be largely environmental in nature, and this kind of character subjects a widespread species to seemingly endless variation, as well as to confusing geographic repetition. The writer has prepared this work in conformity to the general principle stated by Blanchard (1921), namely, that "apparent constancy throughout a definite geographic range is sufficient to warrant the recognition of a name." Intergradation, as evidenced by a significant degree of morphological approach or overlap, when confined to a point or line of geographical contact between the two or more diverging populations concerned, has been the criterion for the recognition of subspecies. However, some modification of this idea must be used in the treatment of insular races that are based only on color or color pattern. A number of island subspecies are recognized here, but none of these vary greatly from their mainland prototypes in scutellation or in bodily proportions. In these cases an apparently constant difference in coloration is usually maintained by each form. Thus, two or more geographical races, which are obviously closely related, may show a really fundamental color divergence or evolution in spite of a continued uniformity in other physical characteristics.

The amount of evolution undergone is to be judged largely by quantitative methods. If the color or pattern differences are great and all color stages in the life history of each supposed form are strikingly distinct, the divergence is held to have full specific value, but if these differences are small and show no great break from the parent stock, it is evident that a full specific designation for them would hide the true state of their evolutionary divergence. Populations belonging to the latter type are in reality "mere color varieties," as they have frequently been styled, and in order that their true value may not be overemphasized and their relationships thus obscured, they have been given subspecific rank in the following pages even though their free interbreeding be now prevented by one or more water barriers. All of the island subspecies recognized in this paper have apparently formed a separate population for only a short time geologically, and the full species have apparently formed an isolated colony for a much greater length of time. If the isolation of these subspecies continues, many of them will presumably become full species with the passing of another geological epoch, or less. To give them full specific rank now, however, would obviously be a purely theoretical anticipation, rather than a logical interpretation, of nature as it exists to-day.

At times overlapping color phases between insular forms appear on intermediate islands. In such cases it is usually necessary to abandon the name for the central group, retaining the two sufficiently differentiated colonies on the neighboring islands as subspecies. The placing of the synonym under the name of the nearest geographical form has almost always been followed, although the actual basis for this act is found, of course, only by a careful comparison of the characteristics of the biological units concerned.

In *Cnemidophorus*, an admittedly plastic genus, it is apparent that colonies of the same general stock are much more homogeneous on small islands than on larger ones, and that insular forms as a whole show a smaller amplitude of variation than do mainland types. The explanation of this may be reached, perhaps, by a brief consideration of the environment.

From this study it seems logical to assume that a modern wide ranging species has met with and tolerated a large variety of habitat conditions. Furthermore, it has been forced to adjust itself to environmental modifications brought about by the extension of its range through its own migrations or by the agency of geological change. Throughout the area of its distribution the individuals concerned must have reached a satisfactory physiological equilibrium with the environment—at least in regard to such prime factors as temperature, moisture, food, shelter, and breeding sites. Failure to do this would have meant restriction of the range, followed by a steady decrease in the number of individuals, and ultimately it would have spelled extinction. Environmental and mutational differences are usually slight in geographically adjacent populations which show a continuous distribution. The appearance of these differences gives inception to "local races." Although such units are generally not worthy of even subspecific recognition, it appears that they may possess a high degree of evolutionary significance. Thus, it seems logical to believe that the complete isolation of one of these local phases is often the most important step in that benign process which culminates in the birth of a new taxonomic entity. In fact it appears from this study that at least the greatest percentage of new taxonomic forms do arise only after continued isolation from the parent stock, during which time even slight mutations may have become of real significance through inbreeding and accretion.

Because of the fact that island forms are more homogenous it seems permissible to diagnose certain new insular species, or to retain those already described, on a smaller sum total of differences than that necessary to discriminate between mainland populations of a similar stock. As previously mentioned, the one criterion to be used in making a separation is constancy.

When the discrimination is between a mainland form and a recently isolated island type, however, it is often extremely difficult to find reliable characters upon which to base a separation. Here the island population may, even after a very careful comparison with representatives from the neighboring mainland, present a seemingly distinctive set of characters. This may cause one not thoroughly familiar with the actual range of variation of the mainland stock to describe a new insular species (or subspecies) whose representatives may prove to be nothing but duplicates of those of the original form which dwell in more or less distant regions where there are, perhaps, similar bionomic conditions.

In the present instance specimens of the commoner forms have been personally examined at all of the leading American museums both east and west and specimens of the rarer forms and the more critical material have been freely loaned for examination at a central point. This method has given the advantage of comparison of pertinent specimens without the disadvantage on the part of museums at least, of packing, invoicing, and shipping enormous lots, a procedure that is well nigh impossible in many cases. The assembling of data upon many large series not previously studied, and upon many more not previously correlated, has helped greately in working out the distribution and generic relationships of the various forms.

A total of 12,676 lizards have been examined during the progress of this study, including 59 of the 86 types here assigned to the genus. Forty of the 59 types in the American museums are in the collection of the United States National Museum at Washington, and the rest are scattered, but in the leading museums of the country.

Faunal lists have been consulted extensively for records, and the reports of each species, if within the known range, have been accepted. In the following pages the detailed locality records are given for each species. If the report is based on a publication, the latter is cited just after the name of the locality. If specimens supporting the record have been examined by the writer, the name of the museum or museums holding them have been added in abbreviated form (see p. 8 for chart of abbreviations). Thus, at a glance one may learn the *basis* for each report presented.

It is a pleasure for the writer to avail himself of this opportunity to extend his grateful acknowledgments to those institutions and individuals who have cooperated with him in this study. He is particularly indebted to Dr. Frank N. Blanchard, under whose general direction the work has been prepared, for helpful suggestions and criticisms tendered during the preparation of the manuscript. This bulletin, it may be added, forms one of the series of contributions from the Zoological Laboratory of the University of Michigan.

The authorities of all of the museums visited during the progress of this enterprise have made their collections available for study and have placed every facility at the writer's disposal. In this connection his appreciation is extended to Dr. Leonhard Stejneger and Miss Doris M. Cochran of the United States National Museum; to Dr. Barton W. Evermann and Mr. Joseph R. Slevin of the California Academy of Sciences; to Dr. Thomas Barbour and Mr. Arthur Loveridge of the Museum of Comparative Zoölogy; to Dr. G. K. Noble and Mr. Clifford H. Pope of the American Museum of Natural History; to Dr. Alexander G. Ruthven and Mrs. Helen T. Gaige of the Museum of Zoölogy of the University of Michigan; to Mr. Karl P. Schmidt of the Field Museum of Natural History; to Mr. H. W. Fowler of the Academy of Natural Sciences of Philadelphia; to Dr. Joseph Grinnell and Dr. Jean Lindsdale of the Museum of Vertebrate Zoology of the University of California; to Dr. J. O. Snyder and Mr. G. S. Myers of the Stanford University Museum; to Mr. M. Graham Netting of the Carnegie Museum; to Mr. J. K. Strecker of the Baylor University Museum; to Mr. L. M. Klauber of the

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The writer wishes to express here his appreciation to his wife, May Danheim Burt, who has accompanied him on all of his visits to the museums mentioned above, and has rendered invaluable aid in recording and computing data from the specimens examined. Her interest in the work has been scarcely less than that of the writer himself, and he does not hesitate to say that he feels that her opinions and observations (which have at times differed from his own) have had a great stabilizing influence on the enterprise as a whole.

In connection with the review and interpretation of the literature, valuable aid has been given by various persons and agencies. To these the writer is extremely grateful. Especial acknowledgement is here extended to Dr. Peter O. Okkelberg for the translation of the important Danish articles written by Reinhardt and Lütken (1861, 1862), and to Dr. Carl L. Hubbs for checking the agreement of the specific and subspecific names used in this work.

Mr. H. W. Parker has kindly furnished a list of the type specimens of *Cnemidophorus* in the collection of the British Museum as well as specific information concerning the type of *Cnemidophorus vittatus* Boulenger. Data pertaining to the type of *Cnemidophorus roeschmanni* Werner have been obtained through the kindness of Herr P. de Grijs of the Hamburg Museum.

The author is deeply indebted to Miss Doris M. Cochran of the United States National Museum for the illustrations of color patterns, to Mr. M. Graham Netting of the Carnegie Museum for taking the photographs from which the line drawings were made, and to May Danheim Burt for the preparation of the distributional maps and line drawings.

In the designation of the types of the various forms and in connection with the distributorial records, the names of collections have been abbreviated as follows: *A. N. S. P.*, Academy of Natural Sciences of Philadelphia; *A. M. N. H.*, American Museum of Natural History; *Blanchard*, private collection of Frank N. Blanchard; *B. Y. U.*, Brigham Young University, Provo, Utah; *B. M. N. H.*, British Museum of Natural History; *Burt*, collected by the writer—all to be transferred to one of the leading American museums; *Baylor*, Baylor University, Waco, Texas; *Carnegie*, Carnegie Museum, Pittsburgh, Pa.; *Colo. Agri. Coll.*, Colorado State Agricultural College, Fort Collins, Colo.; *F. M. N. H.*, Field Museum of Natural History; *Gloyd*, private collection of Howard K. Gloyd; *Iowa State*, Iowa State College, Ames, Iowa; *Jewell*, private collection of Minna E. Jewell; *K. S. A. C.*, Kansas State Agricultural College, Manhattan, Kan.; *K. U.*, Kansas University Museum, Lawrence, Kan.; *Klauber*, private collection of L. M. Klauber; *Los Angeles Mus.*, Los Angeles Museum; *Mich.*, Museum of Zoölogy, University of Michigan; *M. C. Z.*, Museum of Comparative Zoölogy; *M. V. Z. U. C.*, Museum of Vertebrate Zoology, University of California; *Okla.*, Oklahoma University, Norman, Okla.; *Ottawa Univ.*, Ottawa University, Ottawa, Kan.; *San Diego Soc. Nat. Hist.*, San Diego Society of Natural History, San Diego, Calif.; *Stanford*, Stanford University; *Taylor*, private collection of Edward H. Taylor[1]; *U. S. N. M.*, United States National Museum; *Washburn*, Washburn University, Topeka, Kan.

References in the text are to author, year and page, and are to be found in full in the bibliography. Many references appear in the synonymies that are not included in the bibliography, however.

HISTORICAL REVIEW

Certain lizards of the genus *Cnemidophorus* have been known to naturalists since the early part of the eighteenth century. Perhaps the first to be carried from the New World were *lemniscatus* and *murinus*. These interesting forms were figured by Seba in his historic work of 1734 and 1735. The first appeared as *Lacerta lemniscata* in the tenth edition of the Systemae Naturae, but the second was overlooked until 1768 when it was named by Laurenti. Only one other species of *Cnemidophorus* was made known by Linnaeus, namely, the *Lacerta sexlineata* of 1766. During the period between 1766 and 1839 the generic position of the two Linnaean species of *Cnemidophorus* was much varied. Although often referred to the large and unwieldly genus *Lacerta*, these early forms were also placed at times in the *Seps* of Laurenti, the *Ameiva* of Meyer, and the *Teius* of Merrem. A third species of *Cnemidophorus* was described as *Seps murinus* by Laurenti in 1768, a fourth as *Ameiva tessellata* by Say in 1823, and a fifth as *Tejus ocellifer* by Spix in 1825. The abundant Mexican species, *deppii* and *guttatus*, were made known by Wiegmann in 1834 in his pioneer contribution, the Herpetologia Mexicana. An excellent summary of the knowledge of the *Cnemidophori* described prior to 1839 was given by Duméril and Bibron in their Erpétologie Générale.

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[1] To be presented to the Kansas University Museum.

During the last half of the past century and the first quarter of the present, many excellent collections, from a wide range of localities, have served as bases for the delineation of a large number of new forms of *Cnemidophorus.* Baird and Girard, Hallowell, Cope, Gadow, and Van Denburgh have been the outstanding contributors to our knowledge of the genus during this period. The earlier of these workers wrote descriptions that were generally brief, and the characters emphasized often proved unimportant later when more forms became known or more specimens became available. Thus, many of the ideas of relationships conveyed in these original descriptions have been of little value. The work of Cope is transitional. This authority, although ever ready to describe a new species when perplexed, was on the whole more correct in his estimates of relationships. He never hesitated to subject his own species as well as those of others to taxonomic change at a moment's notice. This open-mindedness, although on the whole desirable, often brought confusion, as a study of the following tables of synonymy will indicate. In his disregard for the geographic factor in speciation, an act, such as that which prompted his reference to Van Denburgh's western *stejnegeri* as a subspecies of the *grahamii* of Texas, or his allusion to a specimen of *C. tessellatus tessellatus* from Reno, Nev., as his *C. tessellatus multiscutatus* of Cerros Island, often conveys more real truth than the work of others who have overlooked or ignored the geographic repetition of those characters that are definitely correlated with environmental conditions.

More recently, Gadow (1903–1910), in a series of articles based upon the Mexican species of *Cnemidophorus*, has made a serious attempt to show the importance of variational studies in the interpretation of genetic relationships. Unfortunately he selected for his study specimens from a limited, highly diversified area near the present center of distribution of the genus as a whole. Yet, in spite of the fact that the series examined were wholly inadequate, and the difficulties many, some interesting and well-known results were obtained.

Western herpetology has developed greatly through the efforts of the late Doctor Van Denburgh, whose chief contributions have been the building up of the excellent series of specimens in the collection of the California Academy of Sciences and the assembling of locality records and other data on the western species.

In conclusion, it may be noted that the descriptions of the new species of reptiles that have appeared in the present century are typical of a time in which it has become increasingly difficult to find a new form, particularly in North America. As a result of this stress a modern worker in the herpetological field, if he is to continue along the time-worn Linnaean line of describing and cataloguing new species, must almost always resort to the citation of smaller and less obvious differences in his diagnoses. Since such "taxonomic refinements" often prove to be worthless when large series are examined, it appears that the fundamental advances of the future will be brought about largely through the agency of detailed revisional studies in which the variation found is interpreted in the light of phylogenetic relationships. In the almost total absence of these works it is little wonder that so many supposedly new forms prove to be transient or provisional in nature.

Genus CNEMIDOPHORUS Wagler

RACE RUNNERS; WHIPTAILS; GROUND-LIZARDS; BLAUSANAS; ETC.

1758. *Lacerta* (part) LINNAEUS, Syst. Nat., ed. 10, p. 205.—MERREM, Syst. Amph., 1820, p. 62.—HARLAN, Journ. Acad. Nat. Sci. Phila., vol. 6, 1827, p. 17; Med. and Phys. Researches, 1835, p. 144.

1768. *Seps* (part) LAURENTI, Syn. Rept., p. 58.

1820. *Teius* (part) MERREM, Syst. Amph., p. 62.

1823. *Ameiva* SAY (not of Meyer), Long's Exp. Rocky Mts., vol. 2, p. 50.—HARLAN, Journ. Acad. Nat. Sci. Phila., vol. 6, 1827, p. 7; Med. and Phys. Researches, 1835, p. 136.—HOLBROOK, N. Amer. Herpetology, ed. 1, vol. 1, 1836, p. 63.—DE KAY, Zool. New York, pt. 3, Reptiles and Amph., vol. 1, 1842, p. 30.

1825. *Tejus* (part) SPIX, Spec. Nov. Lacert. Bras., p. 21.

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1843. *Aspidoscelis* FITZINGER, Syst. Rept., p. 20 (type species, *C. sexlineatus*),

1857. *Cnemiphorus* DESMAREST, Table alphabet. de Noms vulgaries et sci. de Reptiles et Poissons, Encyclop. d'Hist. nat., 1857, p. 6.

1869. *Verticaria* COPE, Proc. Amer. Philos. Soc., vol. 11, p. 158 (type species, *C. hyperythrus*).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 5, 1897, p. 140; vol. 10, 1922, p. 551.—BURT, Proc. Biol. Soc. Wash., vol. 42, 1929, p. 153.

1870. *Cnemidofhorus* DUGES, La Naturaleza, ser. 1, vol. 1, p. 144.

1885. *Onemidophorus* HOLDER, Revision of Wood's "Animate Creation," New York, p. 45.

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Systematic notes.—As shown in the preceding historical review, several species of *Cnemidophorus* were known before Wagler's description of the genus in 1830. The species originally placed in the genus were eight in number, including *Seps murinus*, *Tejus cyaneus*, *Lacerta caeruleocephala*, *Lacerta lemniscata*, *Tejus ocellifer*, *Tejus ameiva*, *Monitor laterstrigus*, and *Tejus tritaeniatus*. Only four of these forms are now considered valid. Three of them, *murinus*, *lemniscatus*, and *ocellifer*, are here referred to *Cnemidophorus*, but the fourth, now *Ameiva ameiva ameiva*, is the type species of the genus *Ameiva*. The original Latin diagnosis of *Cnemidophorus* may be quoted as follows: "Nares inmeditae infra canthi rostralis apicem obliquo-ovales, rostri apici proximae; cauda Ctenodontos; squamae notaei minimae granulosae; gastraei scutella oblongo-quadrata; antipedes antice serie unica, tibiae subtus serie duplici scutorum. (Dentes maxillares compressi corona bi- aut tri-incisa; plantae pentadactylae.) America."

It is seen from this that Wagler did not mention the distinctive lingual characters of *Cnemidophorus* which offer the only real basis for its separation from *Ameiva*. The placing of the type species of both genera in the former genus shows that he recognized no differences between them and, although later workers have noted the differences that are considered significant here, a greater or lesser number of the forms of each genus has been placed in the other until the present time. Even the type species of *Cnemidophorus*, *murinus*, was not designated as such until the appearance of the Systema Reptilium of Fitzinger in 1843.

The chief distinction thus far advanced for the separation of *Cnemidophorus* from *Ameiva*, no doubt its closest relative, has been based upon the character of the scaly portion of the tongue. *Cnemidophorus* has been said to have an arrow-headed or heart-shaped tongue, the scaly portion being distinctly divided behind, and the corresponding part of the tongue of *Ameiva* has been said to be undivided, the scaly portion being entire and rounded as in the present type species of the genus, *Ameiva ameiva ameiva*. The forms admitted to *Cnemidophorus*, even by supposedly incorrect diagnoses, all show a greater or lesser degree of posterior fission of the scaly portion of the tongue, and are *in this regard* correctly placed. Moreover, many of the recognized Ameivas, which possess from eight to ten longitudinal rows of enlarged ventral scutes are also found to present this condition. Therefore, it seems significant that *Ameiva taeniura* (M. C. Z. No. 25535) from Hispaniola possesses a very markedly heart-shaped tongue, and that Cope (1894) described *Cnemidophorus ameivoides* from a typical specimen of *Ameiva undulata* (A. M. N. H. No. 16316) with less posterior bifurcation of

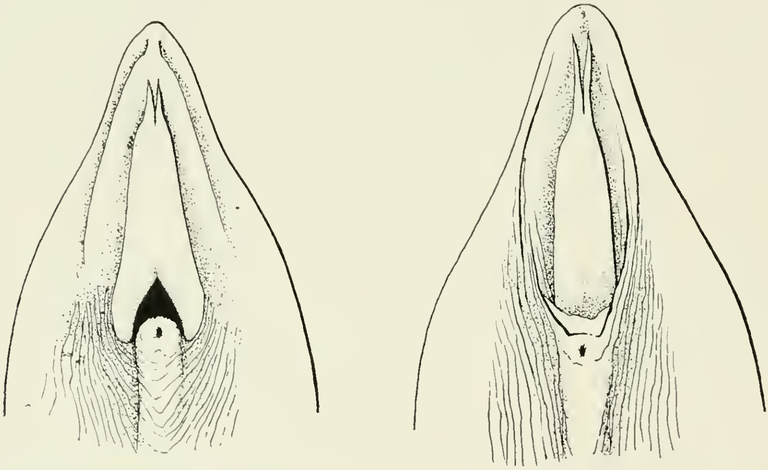

FIGURE 1.—DIAGRAM SHOWING THE TONGUE CHARACTERS OF TYPICAL CNEMIDOPHORUS (LEFT) AND TYPICAL AMEIVA (RIGHT). NOTE THE POSTERIOR BIFURCATION OF THE TONGUE OF CNEMIDOPHORUS AND THE PRESENCE OF A SHEATH BETWEEN THE TONGUE AND LARYNX OF AMEIVA

the tongue than many other specimens of the same species! Thus, even at this date, this criterion was found to be too weak a distinction for a specialist to use with profit and accuracy.

A strong, prominent, posterior lingual sheath is present in *Ameiva ameiva ameiva* and certain of its near relatives. This anatomical detail, as found in this particular section, represents an extreme of divergence from *Cnemidophorus*, in which the sheath is normally absent, and has been mentioned by some workers as a generic distinction. The sheath may sometimes cover the posterior portion of the scaly part of the tongue and this has given rise to the expression "retractile into a basal sheath" as applied to the tongue of *Ameiva* by Boulenger (1885). Here again *Ameiva* offers a close approach to *Cnemidophorus*, since the sheath is noticeably reduced or weak in certain specimens that have been examined, particularly in Mexican *Ameiva undulata* and *Ameiva ameiva praesignis*, the most northern mainland representatives of their genus. In this connection it is noteworthy that the sheath is weakly developed in *murinus*, the type species of *Cnemidophorus*, and even in other forms of the genus (such as Mexican *gularis*) as well. Thus, the sheath is not necessarily a fundamental character, but one subjected to development and loss, as are numerous other pecularities of form that are found in nature.

The amplitude of variation in coloration and in scutellation is great in both *Ameiva* and *Cnemidophorus* and here it seems apparent that the general generic distinctions based upon them are unreliable. Moreover, every attempt to establish a new grouping of the species fails. The writer considers the number of longitudinal rows of ventral plates of considerable phylogenetic significance, and would propose a separation between the species with eight rows and those with ten if it were not for certain forms, such as *Ameiva taeniura*, *Ameiva lineolata*, *Ameiva maynardi*, and *Cnemidophorus murinus arubensis*, which may approach either eight or ten rows, the number depending upon an increase or decrease in the size of the lateral granules which in these forms are almost always present along the outer rows of large, full-sized, ventral plates.

At this point it would seem necessary to synonymize *Cnemidophorus* with *Ameiva*, and it must be admitted that there is considerable argument in favor of this. Yet, in numerous specimens examined, only two have been found that could not, with due allowances, be correctly placed by the differential diagnosis presented in the "Key to *Cnemidophorus* and Allied Genera," which is given below. These two exceptions (*undulata* and *praesignis*, respectively) were both collected in Mexico where the maximum development of *Cnemidophorus* occurs and at the extreme edge of the range of *Ameiva*. Moreover, southern specimens of *undulata* and *praesignis* are readily identifiable.

The writer (1929) has already presented his argument for the union of *Verticaria*, described by Cope (1869), with *Cnemidophorus*. It was found that the single frontoparietal plate of the *Verticaria* section is subjected to considerable variation, being sometimes completely divided as in *Cnemidophorus*, and hence not wholly reliable as a diagnostic character. Also, the large *ceralbensis*, which had been assigned to *Verticaria* by Van Denburgh and Slevin (1921), was found to be an apparent derivative from the *tessellatus* group of *Cnemidophorus*, whereas the small *V. hyperythra* was found to be an obvious derivative from the *sexlineatus* group. Thus, the unreliable nature of the sole generic distinction, and the divided affinities existing in the supposed entity itself, rendered *Verticaria* untenable.

The following key is thought to be sufficient to separate the genus *Cnemidophorus*, as here constituted, from its nearest relatives.

KEY TO CNEMIDOPHORUS AND ALLIED GENERA

1. Hind foot with five well developed toes ---------- 2.
   Hind foot with only four well-developed toes, fifth a mere vestige ---- **Teius.**
   (Confined to southern South America.)
2. Lateral and posterior teeth compressed longitudinally so as to be longer than wide ---------- 3.
   Lateral and posterior teeth compressed transversely so as to be wider than long ---------- **Dicrodon.**
   (Confined to western South America.)
3. Scaly portion of tongue bifid posteriorly, arrow-headed or heart-shaped in outline ---------- 4.
   Scaly portion of tongue not bifid posteriorly, not arrow-headed or heart-shaped in outline ---------- **Ameiva.**
   (Southern South America, northward to Mexico; and the West Indies, northward to Cuba and the Bahama Islands.)
4. Sheath not noticeably developed between larynx and scaly portion of the tongue; dermal fold usually absent at sides of base of tongue. **Cnemidophorus.**
   (Southern Brazil and Bolivia, northward to Oregon, Wisconsin, and Maryland, exclusive of the West Indies.)
   Sheath developed between larynx and scaly portion of tongue; dermal fold present at sides of base of tongue ---------- **Ameiva.**
   (Southern South America, northward to Mexico; and the West Indies, northward to Cuba and the Bahama Islands.)

Diagnosis.—The genus *Cnemidophorus* belongs to the family Teiidae and may be diagnosed as follows: Tongue long, narrow, deeply bifid anteriorly, bilobate or heart-shaped posteriorly, and not retractile into a basal sheath; lateral and posterior teeth compressed longitudinally, bi- or tri-cuspid; anterior teeth simple, usually conical; head covered with large, regular shields, except occipitals or nuchals, which are small and irregular; back and sides covered with small, smooth, granular scales; ventral plates smooth, arranged in regular transverse and longitudinal series, the latter less than 14 in number; tail rounded or subcylindrical; scales on tail different than those on rest of body, forming distinct rings; limbs well developed, all feet with five toes; femoral pores present; anterior and posterior gular folds developed; eye with lids and a round pupil; ear openings large, tympanum exposed; coloration variable.

Description.—Head shields large, head elongate; snout blunt or moderately pointed; occipitals small, uniform or irregular, usually smaller posteriorly, often in regular transverse rows; parietals normally 3 or 5, but sometimes abnormally divided or united; frontoparietals normally 2 or 1; frontal normally entire, seldom divided; prefrontals 2; frontonasal entire, rounded or shield-shaped; rostral moderately blunt; anterior nasals with a common dorsal suture, in contact with first or second upper labial on each side; postnasals separated above by frontonasal plate, smaller than loreal, and forming a suture on each side with the anterior nasals; nostril in suture between nasal plates or anterior to that suture; loreal large, usually forming a suture above with only the prefrontal or with the prefrontal and a posterior, dorsal process of the postnasal; loreal either in contact or not in contact with the first supraocular; supraoculars usually 3 or 4, but sometimes 5 or 6; superciliaries 3–10; supraocular granules minute to larger, rarely extending forward past the anterior border of the second supraocular, often much less; frenoöcular or posterior loreal present or absent; preocular usually entire; suboculars usually 3, but sometimes 4 or 5; postoculars more numerous, smaller, usually forming an elongate temporal ridge in a longitudinal line with the superciliaries; eye with movable upper and lower lids, pupil round, marginal ciliaries minute, arranged in regular series, others smaller and more or less regularly arranged; upper and lower labials approximately the same in number, but often with an additional one or two, above or below, usually 4 to 8 in number; sublabials larger than labials, 3–7 larger ones on each side just posterior to the mentals; anterior or terminal mental usually smaller and narrower than postmental, rounded; a wedge of small scutes or granules often projecting forward between the posterior lower labials and the sublabials; tympanum large, exposed, rounded anteriorly.

Gular region varied in scalation; anterior and posterior gular folds present; anterior gular scales larger than the granular posterior gulars and sometimes abruptly differentiated from them; anterior gulars uniform or graded, often enlarged centrally or medio-laterally, or in both ways; a median dermal fold often present anteriorly just behind the mental scute and just between the paired anterior sublabial plates; mesoptychial or collar scales, between the gular folds, variable, small to large, enlarged series usually forming from 1 to 6 transverse rows, these often larger centrally, but sometimes uniform in size, or enlarged medio-laterally; post-mesoptychial granules extremely minute, often hidden behind posterior gular fold, but sometimes extending forward over the edge of that fold to border the posterior row of enlarged mesoptychials.

Back and sides covered by series of very fine granules, these abruptly differentiated from the much larger scales of the lower surfaces and of the tail, ventral plates smooth, arranged in regular longitudinal and transverse series, the former 8 to 12 in number, but 8 in all but *murinus*; preanals enlarged, differentiated, often 3, but actually varying from 1 to 15 in number; anal slit transverse; preanal spurs present or absent.

Limbs well developed, moderately slender, usually strong; digits 5–5; each digit with a moderately curved, short, thickened claw; subdigital lamellae small, transversely elongated, ridged, and in a single series; supradigital scales larger, flattened, transversely elongated, also in a single series, and often varying in size, particularly on the hind foot; palmar surfaces of feet usually with moderately enlarged, flattened scutes and granules, but sometimes with tubercules, particularly on the forefeet; a comb-like series of more or less elevated and enlarged scutes usually forming the external margin of the sole of the hind foot; brachials small to large, usually in 5-10 rows; antebrachials, larger than brachials, usually in 2 to 5 rows; brachials more or less continuous with antebrachials at a point of contact; postantebrachium with small granules, polygones, or scutes; upper surface of hind limb covered by granules similar to those on back; lower surfaces covered by scutes; femorals large, usually in 5 to 10 rows; tibials smaller or larger, but in fewer rows, usually in 2 to 5 rows; femoral pores present, 7 to 45 in number.

Tail elongate, tapering, covered by small to large plates, these forming distinct rings or annuli; caudal scutes usually larger below than above; lateral caudals usually more or less oblique; keels usually present on dorsal and lateral caudals, but often absent from the ventral scutes, especially anteriorly; lateral keels forming distinct longitudinal ridges in certain species, but irregularly arranged in others.

In *Cnemidophorus* as a whole there is a remarkable amount of geographic and ontogenetic variation in the color and color pattern, particularly within specific limits. It is true that some of the species, such as those of the *hyperythrus* group, are striped throughout life, and others, such as *bacatus*, *nigricolor*, and *catalinensis*, are spotted or unicolor at all ages, but still other forms, such as *gularis* and *perplexus*, may present both phases in the life history of an individual. Because of this, Cope (1900) wrote that "the color markings differ in the same individual at different ages, and the age at which the adult coloration is assumed differs in different localities. Some of the species * * * never abandon the coloration of the young of other species and subspecies." Meek (1905, p. 13) elaborated this comment as follows: "Most of the forms of this genus undergo a color metamorphosis. The result is that the species have been unduly multiplied. Professor Cope noted this change in color pattern and regarded it not due to age, because all specimens having the same color pattern were not of equal size. In this connection it must be remembered that cold-blooded animals do not, in general, grow as uniformly as warm-blooded ones, so two lizards of the same age may differ greatly in size. The color pattern of a particular stage may develop quite independently of age. About all that we can say in this regard is that one particular pattern appears before another certain one does, and that the earlier pattern is usually associated with the smaller individuals."

It may be said here that the color pattern of these lizards is so variable that it is not wise to make generalizations regarding it. As shown elsewhere, the influence of the environment upon the coloration has been great and the color patterns of the more distantly related species may approach each other very closely as do those of certain examples of *tessellatus* and *gularis*, or of *deppii* and *lemniscatus*, or even of *lemniscatus* and *sexlineatus*. However, if a young specimen is spotted, it is fairly certain that it will remain so, or become unicolor, as it grows older, but if a young specimen is lined, it may or may not pass through an intricate series of pattern stages, including the spotted phase, before reaching old age. The methods of pattern change vary with the species. For instance, in *gularis* and *perplexus* of the *sexlineatus* group spots appear in the fields of the six to eight lined young, expand, and unite with the stripes to destroy their even contour and to produce a tessellated pattern (see fig. 22). In *sexlineatus*, however, spots do not appear and all examples are lined throughout life. In *lemiscatus* stripes disappear, not by uniting with the field spots, but apparently by fading. Here sexual dimorphism in the loss of stripes seems to be in evidence, the males losing their lines much more completely and at an earlier age (see fig. 7).

In *Cnemidophorus* each penial lobe (Cope, 1900, p. 557) has a pattern which consists of numerous, delicate, imbricate, transverse lamellae, which are closely applied to each other. Opposite the sulcus spermaticus many Teiid genera display a welt which has free borders. These borders are pectinate in *Cnemidophorus*. There is apparently no difference in the penial characters of *Cnemidiphorus* and *Ameiva*.

The teeth are numerous, conical anteriorly, and bi- or tri-cuspid laterally and posteriorly. The lateral and posterior teeth are longitudinally compressed. There are no teeth in the roof of the mouth (vomerine, palatine, etc.).

The skull is weak, rather frail, and with the usual single, upper temporal arch of the lizards. The frontal bones are coösified, etched, and differentiated from the prefrontals. The parietals are fused to each other and the postfrontalis fused with the postorbital.

As remarked by Cope (1900, p. 557) the urinary bladder is absent from *Cnemidophorus*, there being no trace of it in the species examined during the course of the present study. The kidney is unusually thick and is roughly triangular in outline, being widened transversely at its anterior part. The ureters are short, connecting directly with the cloaca.

The alimentary canal presents the usual parts. The mouth is small and not really capacious. There is an elongate esophagus leading to the stomach, which in turn leads to the convoluted small intestine, rectum and cloaca. A caecum is not present.

Variation.—There is a decided lack of variational studies upon North American lizards, with particularily reference to the abundant, wide-ranging forms. Therefore, it is not considered safe to draw general conclusions here. Comprehensive reviews have appeared for certain genera of snakes, particularly those of Ruthven (1908), Blanchard (1921) and Ortenburger (1928). These writers have been able to discuss at length the variation in the ventral, caudal, dorsal, and labial scutellation of their forms, but this type of scalation in *Cnemidophorus* is seldom significant and therefore there is little need or opportunity to elaborate it here.

In the several groups of *Cnemidophorus*, it is found that most of the forms are only color or size variants, and furthermore the greater percentage of the numerous characters exhibited by the many species and subspecies are useless for diagnostic purposes. Among the most reliable taxonomic characters are the following: the position of the nasal opening, the number of parietal plates, the number of frontoparietals, the number of supraoculars, the type of postantebrachial scutellation, the number of femoral pores and the coloration. Abnormalities frequently occur in the scutellation, both by splitting and by fusion, and, as already shown, there is much confusing variation in the color and color pattern.

Range.—Lizards of the genus *Cnemidophorus* may be found from southern Brazil and Bolivia in South America northward to Oregon, Wisconsin, and Maryland in the United States. Insular races are particularly abundant in the Caribbean Sea and in the Gulf of California.

Habitat.—There is great diversity in the type of habitat occupied by the various forms, and even by the populations or phases of the same form. As shown by Cope (1892*e*, p. 30), "The species of *Cnemidophorus* usually inhabit dry, open places where they can observe their insect prey and watch their enemies. From the latter they escape by the extreme rapidity of their movements, which renders it difficult to follow them with the eye, to which they appear as a streak flying over the ground."

Gadow (1906, p. 278), after working in Mexico, offered the following comment: "When, as in Guerrero, during the rainy season a dense mass of herbs springs up almost everywhere, no ground lizards can be seen except in the narrow tracks across which they flit to hide in the tangle upon being warned by our approach. Moreover, they are very local, and they do not always appear. Rain, certain winds, or a dull sky may keep them in their lairs. One may ride for days and not see a single specimen. Then suddenly there may be hundreds, and what are really members of one clan or even of one family may be collected. The next few days again may yield nothing or only a single specimen here and there; and this is really worse than nothing, for it leaves it undecided whether its characters are truly typical of that district, or merely individual."

* * * "Mexico is an ideal country for the study of geographical distribution, because it contains, often in juxtaposition, vast semideserts, high plateaus, big continuous ranges of mountains with peaks in the eternal snow, hot lowlands of the Atlantic or humid type with luxurious rain forests, and of the Pacific or drier type; large forests of pines, oaks, or of tropical trees; rivers and lakes; regions of enormous fertility and hopeless deserts. In short, every climate and every conceivable kind of bionomic condition is to be found in this country. No wonder that such diversity is expressed in the well-nigh endless kaleidoscopic variation of *Cnemidophorus*, the main genus of strictly humivagous lizards of the country."

It may be remarked here that similar conditions and variations to those described above may be found in the United States and in Lower California. An elaboration of this subject will be found below in the discussion of the various forms.

Habits.—Most of the notes relating to habits are based upon more or less sketchy field observations and pertain chiefly to the behavior of these lizards after being disturbed by the collector. Also, the results obtained from various examinations of stomach contents have been recorded. The available data tend to indicate that the species of *Cnemidophorus* are egg-laying, diurnal, chiefly insectivorous animals. The details pertaining to the life-history of most of the forms remain entirely unknown.

The fullest accounts of the habits of these lizards are given below under *tessellatus*, *sexlineatus*, and *perplexus*.

SUBDIVISIONS OF THE GENUS CNEMIDOPHORUS

The 25 forms of *Cnemidophorus* recognized here fall naturally into five groups. It seems impossible to prepare a simple, usable synopsis for the determination of every specimen, since the amplitude of variation exhibited by certain phases within the several groups is found to overlap. Yet, it is believed that every species may be correctly placed by the following key if a representative series is available. It will be noted that young specimens are needed for use in separating the *tessellatus* group from the *deppii* and *sexlineatus* groups.

KEY TO THE GROUPS OF CNEMIDOPHORUS

1. Parietals normally three; nostril usually anterior to nasal suture........2.
   Parietals normally five; nostril usually in the suture between the nasal plates........**LEMNISCATUS GROUP**, p. 30.
   (Central America and South America.)
2. Frontoparietal plates normally two........3.
   Frontoparietal plate normally one........**HYPERYTHRUS GROUP**, p. 226.
   (Southern California and Lower California.)
3. Sides of young completely striped, and spots, if present, confined to the dark interspaces........4.
   Sides of young not completely striped, but with tessellations, cross-bars or spots........**TESSELLATUS GROUP**, p. 146.
   (Western United States, northern Mexico, and Lower California.)
4. Supraoculars normally four........**SEXLINEATUS GROUP**, p. 76.
   (United States, Mexico, and Guatemala.)
   Supraoculars normally three........**DEPPII GROUP**, p. 56.

A consideration of the origin and relationships of these groups is reserved for the general discussion at the end of this work (pp. 251–260).

FORMS WRONGLY ASSIGNED TO CNEMIDOPHORUS

Numerous forms have been assigned to *Cnemidophorus* that should now be regarded as members of other genera. The following list gives the particulars concerning these reports, and for the sake of completeness and in the hope that it may prove useful to future workers, it is included here.

Table of forms wrongly assigned to Cnemidophorus

Date	Species	Suggested Status
1834	*C. undulatus* Wiegmann	*Ameiva undulata.*[1]
1839	*C. lacertoides* Duméril and Bibron	*Ameiva lacertoides.*
1845	*C. longicauda* (Gray)	*Ameiva longicauda.*
1845	*C. heterolepis* Tschudi	*Dicrodon heterolepis.*[2]
1855	*C. praesignis* Girard	*Ameiva ameiva praesignis.*
1856	*C. festivus* Lichtenstein	*Ameiva festiva.*
1860	*C. quadrilineatus* Hallowell	*Ameiva undulata.*[1]
1869	*C. multilineatus* Philippi	*Ameiva longicauda.*
1869	*C. lacertinus* Philippi	*Ameiva lacertoides.*
1869	*C. grandensis* Cope	*Ameiva lacertoides.*
1876	*C. armatulus* Cope	*Ameiva edracantha.*
1879	*C. maculatus* Fischer	*Ameiva ameiva praesignis.*
1883	*C. affinis* Fischer	*Ameiva chrysolaema.*
1891	*C. centropyx* Steindachner	*Dicrodon heterolepis.*[2]
1891	*C. peruanus* Steindachner	*Dicrodon heterolepis.*[2]
1891	*C. tumbezanus* Steindachner	*Dicrodon heterolepis.*[2]
1892	*C. lentiginosus* Garman	*Dicrodon lentiginosus.*
1894	*C. amivoides* Cope	*Ameiva undulata.*[1]
1897	*C. leachi* Peracca	*Ameiva lacertoides.*
1902	*C. vittatus* Boulenger	*Ameiva vittata.*
1910	*C. roeschmanni* Werner	*Ameiva ameiva ameiva.*[3]
1928	*C. calcaratus* Sinitsin	*Kentropyx calcaratus.*

[1] The described subspecies of *Ameiva undulata* are not worthy of recognition.

[2] The writer expects to give full systematic treatment to *Dicrodon heterolepis* in a forthcoming report on "The South American Lizards in the Collection of the American Museum of Natural History."

[3] Herr P. de Grijs of the Hamburg Museum, after examining the type of *Cnemidophorus roeschmanni* Werner and comparing its characters with those elaborated in the original description, believes it to be identical with *Ameiva ameiva ameiva*. The coloration is found to be "exactly like that of young *Ameiva ameiva ameiva*." With this information the writer feels no hesitancy in regarding *Cnemidophorus roeschmanni* as a synonym of *Ameiva ameiva ameiva*.

KEY TO THE FORMS OF CNEMIDOPHORUS

The following key has been used on many specimens and, in spite of all efforts, it is necessary to offer it with the knowledge that some difficulty is to be experienced in the identification of certain types of individuals, principally intergrades and anomalies. Nevertheless, it will identify the great majority of specimens.

The amount of variation found in many of the species is almost unbelievable, and therefore, the distinctions used have often been either extremely slight or of only normal or average value, so whenever possible, additional alternatives have been introduced in order to increase the certainty of making correct identifications. In view of this, the impossibility of preparing a serviceable *natural or phylogenetic key* to the forms is at once apparent.

1. Large ventral plates in less than 10 longitudinal series---------- 2.
   Large ventral plates in 10 or more longitudinal series.
   C. murinus murinus (Laurenti), p. 46.
   (Bonaire and Curaçao, Dutch Leeward Islands).
2. Frontoparietal plate double[2]---------- 3.
   Frontoparietal plate single[2]---------- 46.

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[2] In the section in which the frontoparietal plate is double, sometimes additional sutures may occur, multiplying the number of plates. Also an occasional variant may be found with a single frontoparietal plate, which will, however, usually be partly divided. Conversely, in the section in which the frontoparietal plate is characteristically single, an occasional specimen will be found in which the frontoparietal plate is partly or even wholly divided. These variants are rare and occur chiefly in *tessellatus, hyperythrus,* and *deppii.*

3. Large parietal scutes normally five; nostril in suture between anterior and posterior nasal plates; anal spurs often present................51.
   Large parietal scutes normally three; nostril anterior to suture between the anterior and posterior nasal plates; anal spurs absent............4.
4. Lower lateral stripes of uniform width, not irregular, wavy, tessellated or broken; crossbars absent..................................5.
   Lower lateral stripes, if present, irregular, wavy, tessellated or broken; crossbars present or absent..................................29.
5. Spots not present in the lateral fields..................................9.
   Spots present in the lateral fields..................................6.
6. Posterior side of forearm with a patch of enlarged scutes or polygones..23.
   Posterior side of forearm covered with granules..........................7.

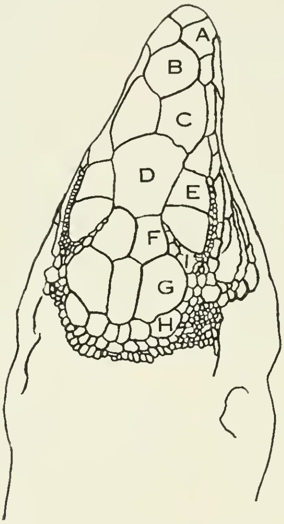

Figure 2.—Cnemidophorus guttatus. Top of head. *A*, anterior nasal; *B*, frontonasal; *C*, prefrontal; *D*, frontal; *E*, supraocular; *F*, frontoparietal; *G*, parietal; *H*, occipital; *I*, supraocular granules

7. Supraoculars four..8.
   Supraoculars three..................**C. deppii deppii** (Wiegmann), p. 56.
   (Mexican coast southward from Nayarit and Vera Cruz through Central America to Costa Rica.)
8. Back with less than nine lines..................................23.
   Back with nine or more lines..........**C. deppii deppii** (Wiegmann), p. 56.
   (Mexican coast southward from Nayarit and Vera Cruz through Central America to Costa Rica.)
9. Back with less than nine lines..................................10.
   Back with nine or more lines..........**C. deppii deppii** (Wiegmann), p. 56.
   (Mexican coast southward from Nayarit and Vera Cruz through Central America to Costa Rica.)
10. Anterior nasal separated from second upper labial on both sides.......12.
    Anterior nasal in contact with second upper labial at least on one side..11.

11. Field between lower lateral stripes on each side reddish, in distinct contrast to the darker ground color of back; femoral pores less than 16.
C. labialis (Stejneger), p. 141.
(Lower California from San Quentin to Cerros Island.)
Coloration different; femoral pores often more than 16________________12.
12. Dorsal stripes complete, not broken into about four rows of white spots__13.
Dorsal stripes incomplete, broken into about four rows of white spots.
C. guttatus (Wiegmann), p. 66.
(Mexican coast southward from Vera Cruz and Michoacan to Chiapas.)
13. Posterior side of forearm covered with granules________________________14.
Posterior side of forearm with a patch of enlarged scutes or polygones__23.

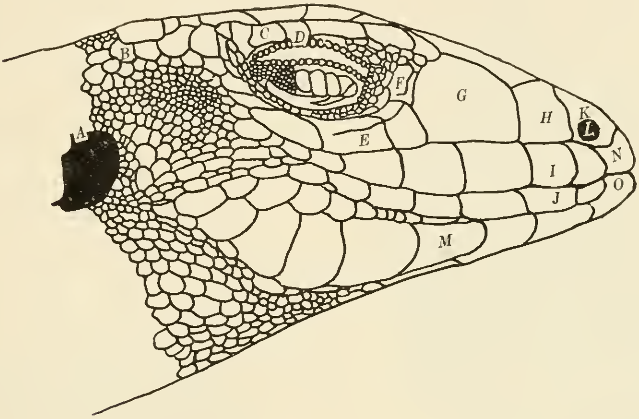

Figure 3.—Cnemidophorus tessellatus rubidus. Side of head. *A*, Tympanum; *B*, postocular; *C*, superciliary; *D*, ciliaries; *E*, subocular; *F*, preocular; *G*, loreal; *H*, postnasal; *I*, upper labial; *J*, lower labial; *K*, anterior nasal; *L*, nostril; *M*, sublabial; *N*, rostral; *O*, anterior mental or chin-shield

14. Supraoculars normally four; granules between last supraocular and median head plates usually few, often, especially in the United States, not extending forward past the posterior border of the third supraocular___16.
Supraoculars normally three; granules between last supraocular and median head scales usually small and numerous, often extending forward past the posterior border of the third supraocular__________________15.
15. Body usually over 80 mm. long (snout to anus); size large.
C. guttatus (Wiegmann), p. 66.
(Mexican coast southward from Vera Cruz and Michoacan to Chiapas.)
Body usually less than 80 mm. long; size small.
C. deppii deppii (Wiegmann), p. 56.
(Mexican coast southward from Nayarit and Vera Cruz through Central America to Costa Rica.)
16. Body with less than eight narrow stripes________________________19.
Body with eight narrow stripes____________________________________17.

17. Dorsal stripes often indistinct, usually wavy, and of lesser intensity than the lateral stripes; yellowish middorsal streak often present__________18.

Dorsal stripes distinct, straight, and of same intensity as lateral stripes; yellowish middorsal streak absent.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico, and western Texas into northern Mexico.)

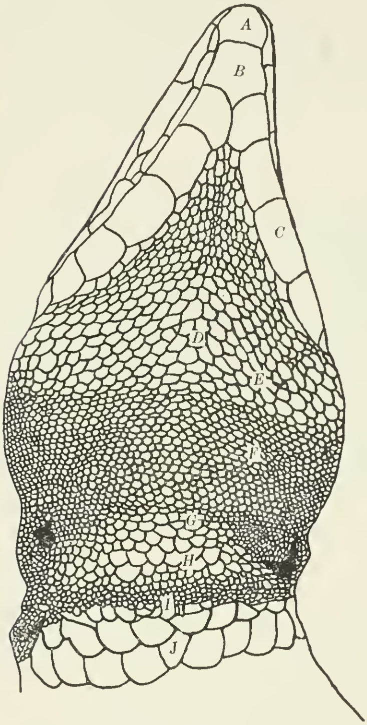

Figure 4.—Cnemidophorus tessellatus rubidus. Gular region *A*, anterior mental; *B*, posterior mental (postnasal); *C*, sublabial; *D*, patch of enlarged central scales; *E*, anterior gulars; *F*, posterior gulars; *G*, region of anterior gular fold; *H*, mesoptychium (region between anterior and posterior gular folds); *I*, region of posterior gular fold with postmesoptychial granules extending over edge; *J*, large ventral scutes

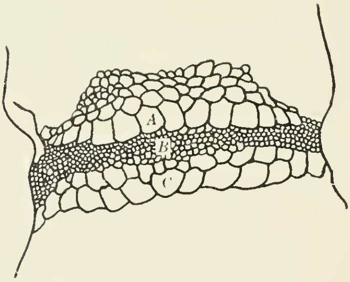

Figure 5.—Cnemidophorus sexlineatus gularis. Mesoptychial region showing large scales on the edge of the posterior gular fold. Note differences from C. tessellatus rubidus (fig. 4). *A*, plates at edge of large posterior mesoptychial (gular) fold; *B*, postmesoptychial granules; *C*, large ventral scutes

18. Ventral surfaces predominantly light in color (unless stained).

C. sexlineatus sexlineatus (Linnaeus), p. 76.

(Eastern coastal plain from New Jersey to Florida; also, the Mississippi Valley northward to Wisconsin and west to the Rocky Mountains.)

Ventral surfaces suffused with much dark bluish, particularily in the thoracic and abdominal regions.

C. sexlineatus gularis (Baird and Girard), p. 97.

(Oklahoma, Texas, central Chihuahua and Sinaloa, south to Guatemala.)

19. A narrow middorsal stripe absent---21.

A narrow middorsal stripe present--20.

20. Middorsal stripe usually wavy; general ground color varied, often blackish (especially southern Florida and certain areas in Tennessee and Texas), brownish, or grayish; at times lower lateral field abruptly lighter (grayish), than, and sharply contrasted with, an upper lateral field of brownish or blackish (west); dorsal granules usually finely granular (east), but often larger (west); an indefinite, yellowish middorsal streak sometimes present------------------**C. sexlineatus sexlineatus** (Linnaeus), p. 76.

(Eastern coastal plain from New Jersey to Florida; also the Mississippi Valley north to Wisconsin and west to the Rocky Mountains.)

Middorsal stripe usually straight; general ground color brownish or grayish, rarely black, that of the lower lateral field (although sometimes lighter) not abruptly contrasted with the ground color of the upper lateral field; dorsal granules usually relatively large; yellowish middorsal streak absent--------------**C. sexlineatus perplexus** (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico and western Texas into northern Mexico.)

21. Dorsal stripes closer to stripes below them than to each other; yellowish middorsal streak usually present------------------------------------22.

Dorsal stripes closer to each other than to stripes below them; yellowish middorsal streak never persent.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico and western Texas into northern Mexico.)

22. A widened, poorly defined, yellowish, middorsal streak usually present, at least anteriorly; ground color varied, often blackish; color of back often abruptly lighter than that of the lateral fields; ground color of lower lateral fields sometimes grayish in contrast to dark of upper lateral field; dorsal granules usually fine (east), but sometimes coarser (west).

C. sexlineatus sexlineatus (Linnaeus), p. 76.

(Eastern coastal plain from New Jersey to Florida; also, the Mississippi Valley north to Wisconsin and west to the Rocky Mountains.)

Ground color of back and sides a uniform grayish or brownish, seldom blackish (Arizona); ground color of sides, although sometimes a little lighter, not abruptly contrasted with that of black; dorsal granules usually coarse---------------**C. sexlineatus perplexus** (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico and western Texas into northern Mexico.)

23. Back with less than eight narrow stripes-----------------------------25.

Back with eight narrow stripes-------------------------------------24.

24. Dorsal stripes often indistinct, usually wavy, of lesser intensity than lateral stripes; yellowish middorsal streak sometimes present---------------28.

Dorsal stripes distinct, straight, of same intensity as lateral stripes; yellowish middorsal streak absent.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico and western Texas into northern Mexico.)

25. Back with less than seven stripes-----------------------------------27.

Back with seven stripes--26.

26. Middorsal stripe usually lighter and narrower than lateral stripes, wavy, complete or incomplete; yellowish middorsal streak sometimes present__28.

Middorsal stripe of same intensity and width as lateral stripes, straight, complete or incomplete; yellowish middorsal streak absent.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico and western Texas into northern Mexico.)

27. Yellowish middorsal streak absent; area between two upper stripes essentially of same color as sides, often a trifle darker________________28.

Yellowish middorsal streak present; area between two dorsal stripes, at least in part, lighter than ground color of sides.

C. sexlineatus gularis (Baird and Girard), p. 97.

(Oklahoma, Texas, Central Chihuahua and Sinaloa, south to Guatemala.)

28. Ventral surfaces predominantly light in color, unless stained (dark specimens usually appear to be black below, instead of blue or dark-black); dorsal stripes often closer to each other than to the stripes below them.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico, and western Texas into northern Mexico.)

Ventral surfaces usually suffused with dark bluish; dorsal stripes usually closer to stripes below them than to each other.

C. sexlineatus gularis (Baird and Girard), p. 97.

(Oklahoma, Texas, central Chihuahua, and Sinaloa, south to Guatemala.)

29. Posterior side of forearm covered with small or slightly enlarged granules________________________________31.

Posterior side of forearm with large scutes or polygones______________30.

30. Ventral surfaces predominantly light in color, unless stained (normal specimens often with a little light blue, but darkened specimens appear to be black below); yellowish middorsal streak absent.

C. sexlineatus perplexus (Baird and Girard), p. 122.

(Utah and Colorado, south through Arizona, New Mexico, and western Texas into northern Mexico.)

Ventral surfaces more or less suffused with dark bluish or blue-black; yellowish middorsal streak or light area sometimes present.

C. sexlineatus gularis (Baird and Girard), p. 97.

(Oklahoma, Texas, central Chihuahua, and Sinaloa, south to Guatemala.)

31. Dorsal and lateral markings besides spots present; back striped or reticulated; sides often cross-barred______________________________38.

Back unicolor or more or less covered with small rounded spots; no reticulations or cross-bars present on back or sides; dorsal markings never with decided indications of longitudinal arrangement_________32.

32. Back and sides with small light spots, at least posteriorly__________36.

Back unicolor, unspotted, or with a few dorsal spots only____________33.

33. Under surfaces of tail and feet largely white, yellowish, black or slate__34.

Under surfaces of tail and feet largely red or pinkish.

C. tessellatus rubidus Cope, p. 199.

(Southern Lower California from San Marcos Island to La Paz Bay.)

34. Supraoculars four; posterior supraocular granules usually large and few, often not extending forward past the posterior border of the third supraocular, especially in the United States__________________________35.

Supraoculars three; posterior supraocular granules usually small and many, normally extending forward past the posterior border of the third supraocular............................**C. guttatus** (Wiegmann), p. 66.
(Mexican coast southward from Vera Cruz and Michoacan to Chiapas.)

35. Body over 85 mm. (snout to anus); size large.
C. sexlineatus gularis (Baird and Girard), p. 97.
(Oklahoma, Texas, central Chihuahua, and Sinaloa, south to Guatemala.)

Body under 85 mm.; size small............................40.

36. Body less than 85 mm. long............................37.

Body more than 85 mm. long.
C. sexlineatus gularis (Baird and Girard), p. 97.
(Oklahoma, Texas, central Chihuahua, and Sinaloa, south to Guatemala.)

37. No spotting in the area above the level of the tympanum and anterior to the insertion of the forearm; spots relatively well defined, very small, and not yellowish..............**C. bacatus** Van Denburgh and Slevin, p. 211.
(San Pedro Nolasco Island, Gulf of California, Mexico.)

Spots present in the area above level of tympanum and anterior to the insertion of the forearm; spots often obscure and diffuse, usually orange or yellowish..........**C. catalinensis** Van Denburgh and Slevin, p. 213.
(Santa Catalina Island, Gulf of California, Mexico.)

38. Middorsal region without an unusually broad, unicolor, light brownish band; dorsal ground color of same general intensity as that of sides, or only a narrow median light band present as in *sexlineatus*; back often spotted, tessellated, cross-barred or lined, and if lined, lines often straight............................39.

Middorsal region with an unusually broad, unicolor, light, brownish band; dorsal ground color lighter than that of the sides; stripes, and spots, if present, confined to the lateral region; lines more or less obscure, irregular or wavy............................**C. deppii cozumelus** Gadow, p. 63.
(Cozumel and Mujeres islands, near coast of Quintana Roo, southern Mexico.)

39. Body covered by more or less coarse dorsal markings; usually at least some indication of longitudinal arrangement in the pattern of the dorsal or lateral markings; size often large, length from tip of snout to anus often over 80 mm. in adults; pattern sometimes obscure..............41.

Body covered by fine, close-set, and often poorly defined, dorsal markings and recticulations; little or no indication of longitudinal arrangement in the dorsal markings; size always small, length from tip of snout to anus rarely over 80 mm.[3]............................40.

40. Labials deep or moderate brown or black.
C. tessellatus martyris (Stejneger), p. 205.
(San Pedro Martir and South San Lorenzo islands, Gulf of California, Mexico.)

Labials light gray, slate, or light brown.
C. tessellatus canus (Van Denburgh and Slevin), p. 208.
(Sal Si Puedes, and North, and South San Lorenzo islands, Gulf of California, Mexico.)

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[3] In spite of all efforts to draw a concise distinction betweena minority of specimens of *tessellatus* and the populations here distinguished as *martyris* and *canus*, a few of the former will fit here in so far as the key is concerned. These must be referred to *tessellatus* for reasons that are explained in the text.

41. Supraoculars normally four; back lined or not lined, if lined, lines usually more or less wavy or broken; sides with spots, crossbars or recticulations; spots, if present, usually not bluish________________42.

Supraoculars normally three; back with several stright, narrow, conspicuous lines (rarely only with one); sides, spotted, or with spots and traces of narrow, longitudinal, light lines, but never with crossbars or reticulations; spots often bluish____________________**C. deppii deppii** (Wiegmann), p. 56

(Mexican coast southward from Nayarit and Vera Cruz through Central America to Costa Rica.)

42. Lower surfaces white or covered by a more or less black or slaty suffusion; throat usually white, black or slaty and sometimes with large patches of black, brown or chestnut; sometimes with three irregular dorsal lines____43.

Lower surfaces covered by a more or less bluish or blue-black suffusion; throat white or bluish, and never with large patches of black, brown, or chestnut; not with three irregular dorsal lines.

C. sexlineatus gularis (Baird and Girard), p. 97.

(Oklahoma, Texas, central Chihuahua, and Sinaloa, south to Guatemala.)

43. Dorsal lines or indications of lines, if present and distinct, four or more in number and not unusually wide; color of back varied; throat never with much brown or chestnut; abdomen of young seldom with bluish_ 44.

Dorsal lines or indications of lines (excluding a pair of irregular and widened lower laterals which are often present, one on each side) three in number, irregular and unusually wide; ground color of back and throat of adult usually rich chestnut or brown; abdomen of young often with bluish______________________________**C. maximus** Cope, p. 218.

(Southern Lower California.)

44. Under surface of tail and feet usually white, bluish, black, gray, or yellowish, not more or less suffused with bright red or pink.

C. tessellatus tessellatus (Say), p. 146.

(Western North America from Oregon and Idaho, southeast to Coahuila and west to the Pacific Ocean.)

Under surface of tail and feet usually more or less suffused with bright red or pink, not entirely white, bluish, black, gray, or yellowish____ 45.

45. Black markings on temporal regions absent or few and ill-defined; dorsal and lateral markings on body showing both transverse and longitudinal arrangement in large specimens, at least; each dark unit or spot usually square or rectangular in outline, not noticeably rounded.

C. tessellatus rubidus Cope, p. 199.

(Southern Lower California from San Marcos Island to La Paz Bay.)

Black markings on temporal regions well defined; dorsal and lateral markings on body showing a predominatingly longitudinal arrangement; back covered by alternate longitudinal chains of black and white, individual spots in black chain rarely square or rectangular.

C. tessellatus celeripes (Dickerson), p. 202.

(San José Island, Gulf of California, Mexico.)

46. Dorsal region striped or reticulated, not of one color____ ___________ 47.

Dorsal region not striped or reticulated, unicolor.

C. hyperythrus pictus (Van Denburgh and Slevin), p. 242.

(Monserrate Island, Gulf of California, Mexico.)

47. Lateral stripes distinct and in even continuous lines; spots and crossbars absent; size always small ---------- 48

Lateral stripes more or less broken; at least a few spots or crossbars present; body often tesselated; adults large.
C. ceralbensis (Van Denburgh and Slevin), p. 216.
(Ceralbo Island, Gulf of California, Mexico.)

48. Only one dorsal stripe present, this often forked ---------- 49.

Two or three dorsal stripes present.
C. hyperythrus hyperythrus (Cope), p. 226.
(Southern California and Lower California.)

49. Dorsal stripe of same intensity and width as lateral stripes ---------- 50.

Dorsal stripe not of same intensity and width as lateral stripes, but fainter and usually narrower ---------- **C. hyperythrus hyperythrus** (Cope), p. 226.
(Southern California and Lower California.)

50. Ground color of sides (between the two distinct lateral stripes) reddish gray; dorsal ground color gray or black, abruptly contrasted with lateral ground color ---------- **C. hyperythrus danheimae** Burt, p. 244.
(San José Island, Gulf of California, Mexico.)

Ground color of sides not usually reddish gray, but often reddish or brown; dorsal ground color of same general shade as that of the sides and not in sharp contrast to it ---------- **C. hyperythrus caeruleus**, p. 240.
(Carmen Island, Gulf of California, Mexico.)

51. Femoral pores 14 or more; preanal spurs often present ---------- 52.

Femoral pores less than 14; preanal spurs absent -- **C. ocellifer** (Spix), p. 43.
(Brazil, Paraguay and Bolivia.)

52. Dorsal region without continuous lines ---------- 53.

Dorsal region with continuous lines ---------- 55.

53. Sides unspotted or with small white spots or flecks ---------- 54.

Sides with large rounded spots; adults large.
C. murinus arubensis (Van Lidth de Jeude), p. 51.
(Aruba, Dutch Leeward Islands.)

54. Ground color of middorsal region essentially bluish, at least laterally; sides, darker above, with a dorso-lateral band of brown or black which is abruptly contrasted with the ground color of the middorsal field.
C. lemniscatus lemniscatus (Linnaeus), p. 30.
(Lower levels from Guatemala south to Colombia and northern Brazil, often insular.)

Ground color of middorsal region black, slate, gray, or grayish brown; sides usually dark, but essentially of the same color and of a shade not abruptly contrasted with that of the back -- **C. lemniscatus nigricolor** (Peters), p. 40.
(Islands north of Venezuela from the Aves east to Blanquilla, also, southward on Margarita Island.)

55. Sides not completely striped, often with large blue spots ---------- 56.

Sides completely striped, spots confined to interspaces or absent.
C. lemniscatus lemniscatus (Linnaeus), p. 30.
(Lower levels from Guatemala south to Colombia and northern Brazil, often insular.)

56. Femoral pores usually less than 27; spots on sides smaller.
C. lemniscatus lemniscatus (Linnaeus), p. 30.
(Lower levels from Guatemala south to Colombia and northern Brazil, often insular.)

Femoral pores usually 27 or more; spots on sides larger.
C. murinus arubensis (Van Lidth de Jeude), p. 51.
(Aruba, Dutch Leeward Islands.)

THE LEMNISCATUS GROUP

CNEMIDOPHORUS LEMNISCATUS LEMNISCATUS (Linnaeus)

BLUE RACE-RUNNER

1758. *Lacerta lemniscata* Linnaeus, Syst. Nat., ed. 10, vol. 1, p. 209, (type locality, "Guinea," lapsus calamus for Guiana, S. Amer.); ed. 12, vol. 2, 1766, p. 369.—Bonnaterre, Erpetol., Tabl. Ency. Nature, 1789, p. 48.—Daudin, Hist. nat. Reptiles, vol. 3, 1802, p. 175.—Shaw, Gen. Zool. vol. 3, 1802, p. 238.—Turton, Syst. Nat., English edition of Linnaeus, 1806, p. 668.—Sonnini and Latreille, Hist. nat. Rept., vol. 1, 1802, p. 226.—Kuhl, Beitr. zool. u. vergl. Anat., 1820, p. 117.—Wagler, Nat. Syst. Amph., 1830, p. 154.—Andersson, Bihang till K. Svenska Vet.-Akad. Handl., vol. 26, section 4, No. 1, 1900, p. 16.—Sherborn, Index Animalium (1758–1800), 1902, p. 525.

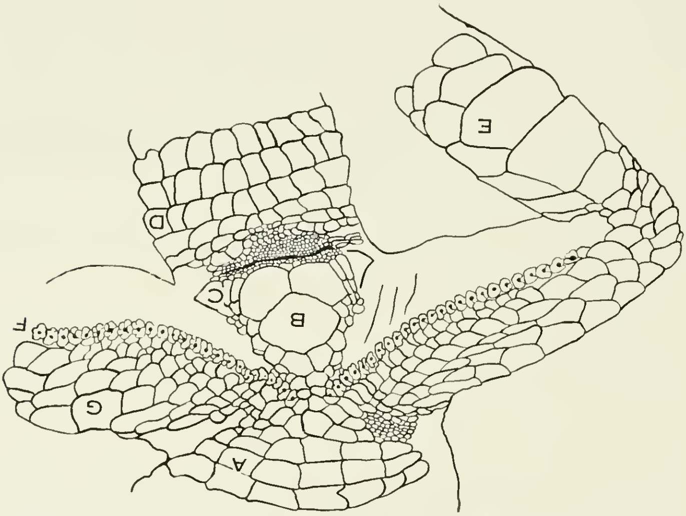

Figure 6.—*Cnemidophorus lemniscatus lemniscatus*. Anal region. *A*, Ventral scutes; *B*, preanal scale; *C*, anal spur; *D*, caudals; *E*, tibials; *F*, femoral pores; *G*, femoral shields

1768. *Seps caeruleus* Laurenti, Synops, Rept., p. 63, (type, locality, America).
1768. *Seps lemniscata* Laurenti, Synops, Rept., p. 60.—Sherborn, Index Animalium (1758–1800), 1902, p. 525.
1789. *Lacerta caerulescens* Bonnaterre, Erpetol., Tabl. Ency. Nature, p. 46.
1820. *Teius lemniscatus* Merrem, Versuch eines Systems der Amphibien, p. 69.
1820. *Teius cyaneus* Merrem, Versuch eines Systems der Amphibien, p. 61 (type locality, "America."—Wagler, Nat. Syst. Amph., 1830, p. 154.
1820. *Lacerta caruleocephala* Kuhl, Beitr. zool. u. vergl. Anat., p. 117.—Wagler, Nat. Syst. Amph., 1830, p. 154.
1823. *Ameira lemniscata* Lichtenstein, Verz. Doubl. zool. Mus. Königl. Univ. zu Berlin, p. 91.—Cuvier, Animal Kingdom, English translation by M'Murtrie, 1831, p. 22.—Griffith, Cuvier's "Animal Kingdom," 1831, p. 114, (footnote).
1831. *Teius (Ameiva) lemniscatus* Gray, Synops. Rept., appx. to Griffith's "Cuvier's Animal Kingdom," p. 31.
1831. *Teyus cyaneus* Griffith, Cuvier's Animal Kingdom, p. 114.
1831. *Teius (Ameira) cyaneus* Gray, Synops. Rept., appx. to Griffith's "Cuvier's Animal Kingdom," p. 30.

1831. *Ameiva cæruleocephala* Griffith, Cuvier's Animal Kingdom, p. 111, (refers to Seba).—Schinz, Naturg. u. abbild. Reptilien, 1833, p. 97.

1831. *Teius (Ameiva) cæruleocephalus* Gray, Synops. Rept., appx. to Griffith's "Cuvier's Animal Kingdom," p. 30.

1834. *Cnemidophorus murinus lemniscatus* Wiegmann, Herpetologia Mexicana, p. 27.

1834. *Cnemidophorus murinus cyaneus* Wiegmann, Herpetologia Mexicana, p. 27.

1838. *Ameiva lineata* Gray, Ann. and Mag. Nat. Hist., ser. 1, vol. 1, p. 278 (type locality, unknown).

1839. *Cnemidophorus lemniscatus* Duméril and Bibron, Erp. gen., vol. 5, p. 128.—Gray, Cat. Liz. British Mus., 1845, p. 21.—Berthold, Mitt. Zool. Mus. Göttingen, vol. 1, 1846, p. 13.—Duméril and Duméril, Cat. méth. Coll. Rept. (Paris Mus.), 1851, p. 116.—Lichtenstein, Nomenclator Musei Zool. Berol., 1856, p. 13.—Jan, Indice Sist. dei Rett. ed Anfibi Mus. Civ. di Milano, 1857, p. 40.—Hallowell, Proc. Acad. Nat. Sci. Phila., 1860, pp. 482–483.—Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 356.—Reinhardt and Lütken, Vidensk. Meddel. nat. Foren. Kjöb., 1862, p. 168.—Westphal-Castelnau, C. R. des trav. de Cong. sci. de France, tenu à Montpellier, in déc. 1868, 1870, p. 19.—Peters, Sitz.-Ber. d. Ges. naturf. Freunde zu Berlin, 1873, p. 76.—Bocourt, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, pp. 269, 273 pl. 20*c*, figs. 2, 2a–*c*; pl. 20*d*, figs. 3, 3a–*b*.—Cope, Journ. Acad Nat. Sci. Phila., ser. 2, vol. 8, 1876, p. 164.—Peters, Monatsb. Berlin Akad. Wissensch., 1877, p. 412.—Müller, Verhandl. Naturf. Ges. Basel, vol. 6, 1878, p. 626.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 363.—Steindachner, Annalen des k. k. natur. Hofmus., Wien, 1891, p. 375.—Cope, Trans. Amer. Philos. Soc., vol. 17, 1892, p. 30.—Boettger, Kat. der Rept. Samml. im Mus. Senckenb. Naturforsch. Ges. in Frankfurt, teil 1, 1893, p. 73.—Mole and Urich, Journ. Trinidad Field Nat. Club, vol. 2, 1894, p. 82.—Cope, Proc. Acad. Nat. Sci. Phila., vol. 46, 1894, p. 199; Sci. Bull. Phila. Museums, no. 1, 1899, p. 9.—Andersson, Bihang till K. Svenska Vet.-Akad. Handl., vol. 26, sect. 4, no. 1, 1900, p. 16.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.—Werner, Verhandl. der k. k. zool.-bot. Ges. Wien, 1900, p. 267.—Lampe, Jahrb. d. Nassauischen Vereins f. Naturkunde, vol. 54, 1901, p. 35.—Stejneger, Proc. U. S. Nat. Mus., vol. 24, 1901, p. 184.—Goeldi, Bol. Mus. Paraense, vol. 3, 1902, pp. 537, 545.—Steindachner, Denkschr. d. mathem.-naturw. Cl. Akad. Wiss. Wien, vol. 72, 1902, p. 101.—Cohn, Zool. Anz., vol. 27, 1903, pp. 185–192.—Boulenger, Ann. and Mag. Nat. Hist., ser. 7, vol. 11, 1903, p. 483.—Rosen, Ann., and Mag. Nat. Hist., ser. 7, vol. 16, 1905, p. 137.—Gadow, Proc. Zool. Soc. London, 1906, p. 301.—Meek, Publ. Field Mus. Nat. Hist., zool. ser., vol. 7, 1910, p. 417.—Werner, Revision of Brehm's Tierleben, vol. 2, 1913, p. 147.—Fowler, Proc. Acad. Nat. Sci. Phila., vol. 65, 1913, p. 173.—Barbour, Mem. Mus. Comp. Zoöl., vol. 44, 1914, p. 218.—Ruthven, Occas. Pap. Mus. Zool. Univ. Mich., no. 16, 1915, p. 4.—Barbour, Proc. Biol. Soc. Wash., vol. 29, 1916, p. 223.—Griffin, Ann. Carnegie Mus., vol. 11, 1917, p. 312.—Barbour, Proc. N. Eng. Zool. Club., vol. 7, 1921, p. 82.—Camp, Bull. Amer. Mus. Nat. Hist., no. 48, 1923, p. 402.—Werner, Zeitschr. f. wissensch. Zool., vol. 125, 1925, p. 545.—Roux, Rev. Suisse de Zool., vol. 33, 1926, p. 292.

1845. *Cnemidophorus scutata* Gray, Cat. Liz. British Mus., p. 21 (type locality, unknown).

1885. *Cnemidophorus deppii* (part) Boulenger, Cat. Liz. British Mus., vol. 2, p. 371 (misidentification of a specimen from Caracas, Venezuela).—Günther, Reptilia and Batr., in "Biol. Cent.-Amer.", 1885, p. 27 (same).

1885. *Cnemidophorus espeuti* Boulenger, Cat. Liz. British Mus., vol. 2, p. 362 (type locality, "Old Providence Island, Colombia"; type specimen, B.M.N.H. 1882.8.8.1.); Zool. Rec. for 1885, vol. 22, "Reptilia," 1886, p. 14; Cat. Liz. British Mus., vol. 3, 1887, p. 505.—Gadow, Proc. Zool. Soc. London, 1906, p. 301.—Barbour, Proc. N. Eng. Zoöl. Club, vol. 7, 1921, p. 82.

1892. *Cnemidophorus espeutii* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 30; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.

1894. *Cnemidophorus murinus* Mole and Urich, Journ. Trinidad Field Nat. Club, vol. 2, p. 82.

1907. *Cnemidophorus espeutii* Atkinson, Ohio Nat., vol. 7, p. 154.

1915. *Cnemidophorus lemniscatus gaigei* Ruthven, Occas. Pap. Mus. Zool. Univ. Mich., no. 16, p. 1 (type locality, "Santa Marta Mountains and vicinity, Colombia"; type specimen, Mich. No. 45352, Frederick M. Gaige, collector).—Regan, Zool. Rec. for 1915, vol. 52, 1917, "Reptilia," p. 14.—Ruthven, Misc. Publ. Mus. Zool. Univ. Mich., no. 8, 1922, p. 61; Occas. Pap. Mus. Zool. Univ. Mich., no. 143, 1923, p. 8.—Barbour, Proc. N. Eng. Zoöl. Club, vol. 10, 1928, p. 60.

1919. *Cnemidophorus lemniscatus lemniscatus* Beebe, Zoologica, vol. 2, p. 212.—Ruthven, Occas. Pap. Mus. Zool. Univ. Mich., no. 143, 1923, p. 8.—Barbour, Proc. N. Eng. Zoöl. Club, vol. 10, 1928, p. 60.—Burt and Burt, Proc. U. S. Nat. Mus., vol. 78, art. 6, 1930, p. 31.

1928. *Cnemidophorus lemniscatus ruatanus* Barbour, Proc. N. Eng. Zool. Club, vol. 10, p. 60 (type locality, "Coxen Hole, Ruatan, Bay Islands of Honduras").—Barbour and Loveridge, Bull. Mus. Comp. Zoöl., vol. 69, 1929, p. 242.

Systematic Notes.—The blue race runner is the oldest known form of *Cnemidophorus*, having been figured by Seba in 1734 as "*Lacerta brasiliensis de Bahia.*[4]" It was given a binomial (*Lacerta lemniscata*) by Linnaeus, who adequately diagnosed it in 1758, and from that time until it was placed in the genus *Cnemidophorus* by Duméril and Bibron in 1839 it was referred to various genera besides the original *Lacerta*. Typical specimens became known as *caeruleus* through Laurenti (1768), as *cyaneus* through Merrem (1820), and as *caeruleocephala* through Kuhl (1820) and others. Bocourt (1874) suggested that the *Ameiva cyanomelas* of Maximilian de Wied-Neuwied (1824) was perhaps *lemniscatus*, but this supposition seems to be rather far fetched, since the photograph shows only two distinct light lines on each side, and a single middorsal line. It would appear that *cyanomelas* was placed in the right genus, and is, perhaps, rather near to *Ameiva septemlineata* or *A. edracantha*.

There is nothing distinctive in the *Ameiva lineata* of Gray (1838), and it is evident that the types were *lemniscatus*. Therefore, Boulenger (1885) is followed in listing it in the synonymy of the present form. *Cnemidophorus scutata*, described by Gray (1845) from an indefinite locality, was imperfectly diagnosed, and Boulenger, with the types available to him, placed it, likewise, in the synonymy of *lemniscatus*.

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[4] Vol. 1, p. 144, pl. 91, fig. 3.

Cnemidophorus espeuti, described from Old Providence Island by Boulenger (1885), has never been clearly diagnosed. An examination of subsequent specimens from this island shows that *espeuti* differs little from the *lemniscatus* of other places. The description "olive above, with a broad lighter dark-edged band from the occiput to the base of the tail" excellently fits a number of examples of *lemniscatus* from Venezuela in the United States National Museum, as well as the type of *Cnemidophorus lemniscatus gaigei* and other specimens. Morever, young examples from Old Providence Island have been found to be lined, and the early loss of stripes is sometimes seen in mainland examples. Furthermore, the four supraoculars, five parietals, and peculiar keeling of the caudal scales attributed to *espeuti* are all common features of *lemniscatus*. Since constant distinguishing characters are not evident, *espeuti* is considered as identical with that form.

Cnemidophorus lemniscatus gaigei, described by Ruthven (1915) from Colombia, was said to differ from *lemniscatus* in its larger size, fewer femoral pores, greater width of the parietal shields, and fewer parietal-postorbital granules.

The maximum size of *gaigei* was listed as 100 mm. (snout to anus) as opposed to the 73 mm. of *lemniscatus*, but a specimen of the latter from British Guiana has been found to have a body length of 85 mm. (A.M.N.H. No. 8734). In the latter place, British Guiana, a number of specimens are found with a body length of over 80 mm., so the appearance of the large specimen cited above can not be regarded as abnormal or accidental. In Venezuela a specimen with a body length of 100 mm. was taken at Cariquito (A.N.S.P. No. 1869): another from Rio Chico measured 88 mm. An example from Old Providence Island (U.S.N.M. No. 13877) has a body length of 96 mm., and larger specimens will probably appear in any general collection of *lemniscatus*. These data show that the size difference is not consistently geographic, and so is of little diagnostic value. Greater size in certain regions may be the result of highly favorable bionomic conditions as maintained by Ruthven himself (1906) in regarding the large "*scalaris*" which occurs near Tucson, Arizona, as a synonym of the much smaller "*gularis*" (— *perplexus*) of the region.

The femoral pores of *gaigei* were said to range from 16 to 24 in number and those of *lemniscatus* from British Guiana from 23 to 29, average 26. Ruthven's data were secured from 48 specimens from British Guiana. The examination of a like number from the same political area, while at the American Museum of Natural History, has shown a range of from 21 to 27 femoral pores, average 23.3. Here, also, the differences appear to be less than those hitherto cited. The appearance of less than 21 femoral pores in specimens from

Brazil and Panama, as well as from Old Providence Island, and the overlapping of the range of variation at many places, renders this distinction untenable.

The width of the parietal shields was said to be as great as the width of the head measured between the superciliaries at the third supraocular in *gaigei* and to be about equal to the distance between the outer margins of the first supraocular plates in *lemniscatus*. The attempt to measure this difference in millimeters failed because the measurement across the soft, pliable supraoculars was too inaccurate. A careful comparison of individuals from various places shows that there is a very extensive overlapping in this character as in the others and that it, too, is of little value.

The outer parietal scales on each side were found to be in contact with the enlarged postorbital scale or separated from it by one or, rarely, two small scales in the series of *gaigei*, but were separated by from two to four scales in the series of *lemniscatus*. It is found that the full contact of the postorbital with the external parietal is of rare occurrence and that the normal condition for certain "typical" *gaigei* is one in which a single connecting scute is present. This is found in the type of *ruatanus*, recently described by Barbour from Ruatan Island, in specimens of *lemniscatus* from the adjacent mainland of Honduras, and in examples from Milford Bay, Tobago, as well. In specimens from many places, including Brazil, two scutes have been found, and it becomes evident that this character, too, is useless in separating populations of the two supposed forms.

Thus, because of the failure of its supposed diagnostic features, *gaigei* can no longer be retained as a distinct entity.

After finding that Laurenti gave the type locality of Seba's specimen as "Guinea", and that Daudin (1802, 180) corrected this to read "Guiana", Ruthven in describing *Cnemidophorus lemniscatus gaigei* proposed that the name, "*C. lemniscatus* Laurenti," type locality "Guiana" be restricted to this area. In a footnote he defended his action as follows: "It may be pointed out that if the name be credited to Daudin, as is usually done, it may still be applied to the British Guiana specimens as the type locality is then "Surinam." The name should be credited to Linnaeus, however, since it appeared in the tenth edition of the Systema Naturae in 1758 as *Lacerta lemniscata* and was also present in the edition of 1766, both of these editions being printed prior to the appearance of Laurenti's treatise in 1768. The original type locality was "Guinea" as copied by Laurenti.

The description of *Cnemidophorus lemniscatus ruatanus* Barbour from Ruatan, one of the Bay Islands of Honduras, has recently appeared (1928). The type was said to differ from *lemniscatus* in the presence of but one parietal-postorbital scute, but it has already been pointed out that this variation occurs in specimens from Milford Bay, Tobago, as well as in those from the mainland of Honduras. Such wide geographical variation in this character renders the distinction untenable.

Ruatanus was found to differ from *gaigei* in that there are but "a couple of elongate shields between the supraoculars and the frontoparietals and parietals—an even more extreme reduction than is seen in the latter form." Since this is frequently seen in Colombian specimens, which, perhaps, after all, represent the extreme in reduction of the number of head granules, it can not be used to separate the two populations. The type of *ruatanus* has a median posterior frontoparietal present, but this variation is clearly an abnormality, which now and then occurs in nearly all of the common species of *Cnemidophorus* and *Ameiva*, including *lemniscatus* itself.

In the original description of *ruatanus* it was written that "It seems probable that more material will show a fairly well defined race to inhabit this island. At the same time it is only fair to say that this species badly needs critical study when sufficient material is accumulated." The writer, however, feels fairly certain that additional material from Ruatan will not uphold *ruatanus*. In regard to the second point, it may be said that the excellent series of specimens examined are sufficient to show that neither *ruatanus*, *gaigei*, nor *espeuti* can be fairly maintained as distinct units.

Diagnosis.—The blue lizard may be distinguished as follows: Ventral plates in 8 longitudinal series; parietals 5; supraoculars normally 4, rarely 3; ventral caudals more or less definitely ridged or keeled; enlarged anal spurs often present; femoral pores 15–29; femora of young distinctly spotted, of adult either spotted or unspotted; young fully lined, with 6–10 stripes, usually with 9; lines present or absent in adult, and if present, lateral stripes distinct, faded, or absent and sides spotted or unspotted; under surfaces white to blue, lower flanks usually brilliant blue or reddish brown, this sometimes continued high laterally in adults.

Description.—Snout rather blunt to moderately pointed; nostril usually in suture between anterior and posterior nasal plates; anterior nasal not in contact with second upper labial; supraoculars normally 4; supraocular granules usually extending forward to the middle of the third supraocular; frontoparietals normally 2; parietals normally 5; anterior and posterior gulars usually poorly differentiated, rather small, often uniform or slightly enlarged centrally or medio-laterally; mesoptychials moderately large, largest medio-laterally or at a point just to the side of the median line, smaller toward the sides, in 1–6 rows, posterior often largest; postmesoptychial granules minute, sometimes extending forward over the edge of the posterior gular fold. It has been observed that smaller mesoptychial scales occur in specimens collected in the lower, more sandy areas, and that larger ones appear in those collected at higher, more brushy, or rocky, elevations.

Body elongate; ventral plates in 8 longitudinal and 27–36 transverse rows; anal spurs often well developed; dorsal granules small; limbs well developed; brachials 3–8; antebrachials 2–4; brachials usually continuous with antebrachials at a point of contact; postantebrachials granular or slightly enlarged; postbrachials small, undifferentiated; femorals 4–7; tibials 2–4; femoral pores[5] 15–29; tail elongate, tapering, with rather strong continuous longitudinal keels; ventral caudals usually ridged and with more or less definite longitudinal keels.

Coloration moderately variable; lower surfaces white to bright blue; lower flanks blue, gray, dusky, brown, greenish, or olivaceous; tail white to slaty below, bright blue in young and sometimes even in the adult, often olivaceous above; femora usually spotted or reticulated with white, but sometimes unicolor; dorsal ground color brownish, olivaceous, gray, bluish, or black; young with from 6 to 10 light stripes, usually with 9; adults lined or without lines, spotted or unspotted; if no lines are present, there may be a more or less distinct dark dorso-lateral streak or band, above which the ground color is essentially bluish or olivaceous.

In a few of the smaller specimens which possess an even number of stripes, particularly from Honduras and northwestern Brazil, a widened yellowish middorsal streak is present as in *sexlineatus*.

A series of 916 specimens of *lemniscatus* has been examined. Measurements on a representative lot of 300 of these are as follows: Body, 31–104 mm.; tail, 78–226; total length, 109–330; width of head, 5–15. The following data were secured from a total of 800 specimens: Parietals, 3 in 1 specimen, 4 in 3 specimens, 5 in 774 specimens, and 6 in 22 specimens (thus, only 0.5 per cent of *lemniscatus* have less than the "normal" 5 parietals); supraoculars, 3–4 in 12 specimens, 4 in 714 specimens, 4–5 in 44 specimens, 5 in 29 specimens, and 5–6 in 1 specimen (thus, only 0.75 per cent of the specimens have less than 4 supraoculars); supraocular granules extending forward to the anterior border of the fourth supraocular in 106 specimens, to the middle of the third supraocular in 680 specimens, to the anterior border of the third supraocular in 12 specimens, and to the anterior border of the second supraocular in 2 specimens.

Variation.—The sexual dimorphism shown by *lemniscatus* in certain areas was noted by Boulenger (1885, p. 363). He showed that there are usually 8 or 9 stripes on the body in the adult female, but only 4 or 5 median, persisting stripes in the male. The latter, in addition, has the flanks spotted with white or blue areas. At times the lower stripes of the female also becomes faint, and the male may lose even the dorsal line. (For an illustration of the colorational difference discussed here see fig. 7). The preanal spurs are well developed in large males, but are usually either vestigial or poorly developed in females and young.

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[5] Cohn (1903, 185–192) has presented an illustrated histological study of the femoral pores of this lizard, demonstrating their glandular nature.

Range.—The blue race runner occurs from northern Brazil and Colombia north to Guatemala. It is found on Tobago and Trinidad, as well as on Old Providence and other recently isolated coastal islands.

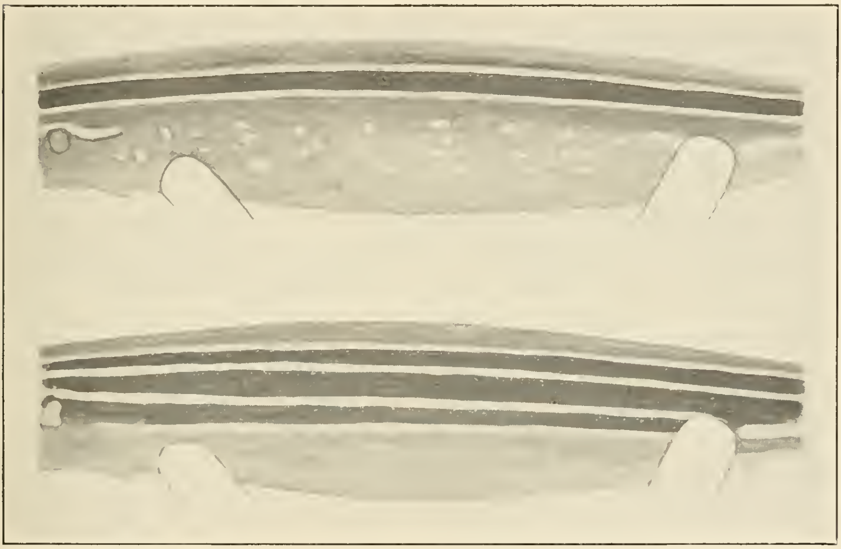

Figure 7.—Cnemidophorus lemniscatus lemniscatus. Color pattern. Adult male, U.S.N.M. No. 22529 (upper). Adult female, U.S.N.M. No. 4352 (lower). Note the sexual dimorphism

The available records are given below in an alphabetical list by countries. All island records are given under the heading "Islands."

BRAZIL.—(*Belem, formerly Para*, Boulenger, 1885, p. 364, M.C.Z.; *Chidos*, M.C.Z.; *Cucuhy*, A.M.N.H.; *Liamó*, A.M.N.H.; *From the Maranon and the Amazonas at Santarem*, Cope, 1876, p. 164; *Santarem*, Boulenger, 1885, p. 364, M.C.Z., A.M.N.H., C.A.S., Mich., Carnegie; *Talmapunta*, A.M.N.H.; *Villa Bella*, M.C.Z.)

COLOMBIA.—(*Aracataca*, Ruthven, 1922, p. 61; *Arroyo de Arenas near Riohacha Ruthven*, 1922, p. 61, Mich.; *Badillo*, Ruthven, 1922, p. 61, Mich.; *Baranquillo*, M.C.Z., Mich.; *Bogotá*, Cope, 1899, p. 9, A.M.N.H.; *Calomar near the mouth of the Rio Magdalena*, Steindachner, 1902, p. 101; *Cartagena*, Cope, 1862, p. 356, U.S.N.M., A.N.S.P.; *Curva del Tigre below Minca*, Mich.; *Don Diego*, Ruthven, 1922, p. 61, Mich.; *Fonseca*, Ruthven, 1922, p. 61, Mich.; *Fundacion*, Ruthven, 1922, p. 61, Mich.; *Girardot*, A.M.N.H.; *Honda*, Griffin, 1917, p. 313, Carnegie, A.M.N.H., M.C.Z.; *La Concepcion*, Ruthven, 1922, p. 61, M.C.Z.; *Las Pavas*, Ruthven, 1922, p. 61; *Loma Larga*, Ruthven, 1922, p. 61, Mich.; *Mamatoco in the Santa Marta Mts.*, Mich.; *between Mamatoco and La Tigrera*, Mich.; *Medellin*, A.M.N.H.; *Minca in the Santa Marta Mts.*, Mich.; *Minca Mts.*, Mich.; *Orocúe*, Werner, 1900, p. 267; *Palomina*, Ruthven, 1922, p. 61, M.C.Z.; *Puerta Berrio*, M.C.Z.; *Quajaria, Santa Marta Mts.*, Mich.; *Rio Barbacoa, Arroyo de Arenas*, Mich.; *Rio Rancheria*, Mich.; *Sabanalarda on the Cauca River*, A.M.N.H.; *Salamanca Coast at Gaira*, Ruthven, 1922, p. 61, Mich.; *San Pablo at the middle of the Rio Magdalena*, Steindachner, 1902, p. 101; *Santa Marta*, Ruthven,

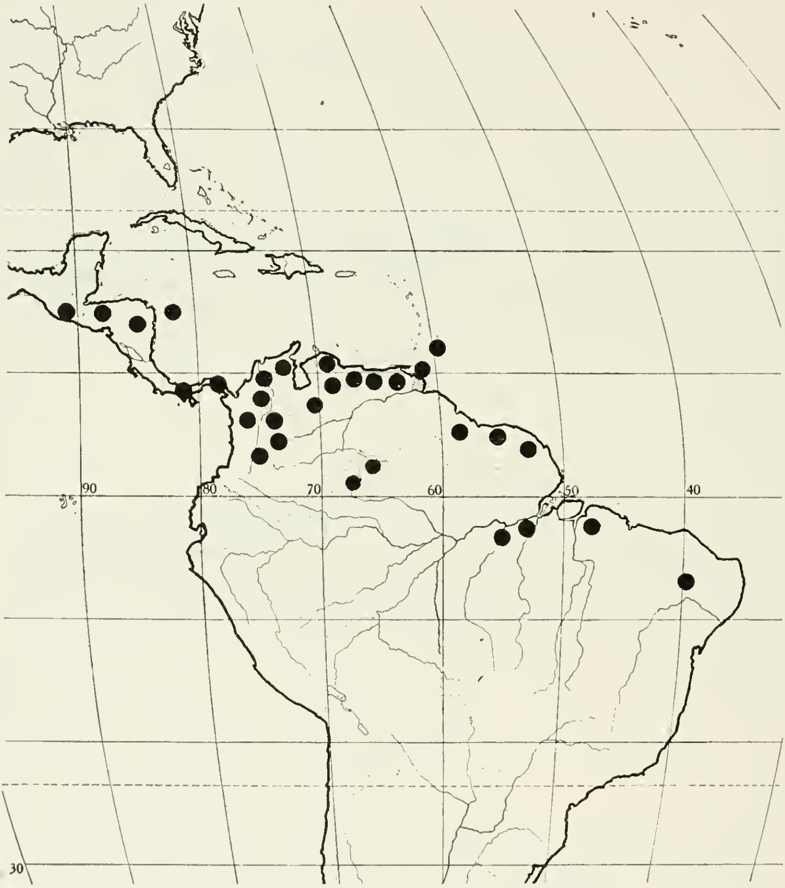

FIGURE 8.—MAP SHOWING LOCALITY RECORDS FOR CNEMIDOPHORUS LEMNISCATUS LEMNISCATUS

1922, p. 61, Mich.; *Tamocal River in the Santa Marta Mts.*, Mich.; *Truando*, U.S.N.M.; *Tucurinca*, Ruthven, 1922, p. 61; *Valle de Upar*, Ruthven, 1922, p. 61, Mich.; *Valencia*, Ruthven, 1922, p. 61.)

GUATEMALA.—(*Gualan*, Atkinson, 1907, p. 155; *Los Amates*, Atkinson, 1907, p. 155.)

GUIANA.—British Guiana (*Berbice*, Boulenger, 1885, p. 364; *Demerara River about 35 miles from Georgetown*, Ruthven, 1915, p. 3; *Dunoon on the Demerara River*, Mich.; *Kartabo*, A.M.N.H., Carnegie). Dutch Guiana (*Paramaribo*, M.C.Z.). French Guiana (*Cayenne*, Duméril and Duméril, 1851, p. 116, A.N.S.P.).

HONDURAS.—(*Coxen Hole, Ruatan, Bay Islands*, Barbour, 1928, p. 60, M.C.Z.; *Puerto Cortes*, F.M.N.H.; *Tela Village, Yoro*, M.C.Z., U.S.N.M., Mich.)

ISLANDS.—(*El Valle on Margarita*,, M.C.Z.; *Martinique, F. W. I.*, Daudin, 1802, p. 182, and others. These specimens were collected by Plee and are, therefore, of none too definite locality, so there is no good proof that the blue lizard occurs on this island. In fact, its occurrence here is very improbable; *Old Providence Island, Colombia*, Boulenger, 1885, p. 363, U.S.N.M., F.M.N.H., *Patas Island*, A.M.N.H.; *St. Thomas, D.W.I.*, Werner, 1900, p. 267, A.N.S.P. This report is no doubt an error and should certainly be verified by new material before its acceptance; *Swan Island*, Cope, 1892, p. 30; *Tobago, B.W.I., at Milford Bay*, Barbour, 1916, p. 223, M.C.Z.; *Trinidad, B.W.I.*, Boulenger, 1885, p. 364, Carnegie.)

NICARAGUA.—(*Granada*, F.M.N.H.)

PANAMA and the CANAL ZONE.—(*Ancon*, M.C.Z.; *Camp Creek, Darien, at Lelam Falls*, A.M.N.H.; *Darien*, A.M.N.H.; *Obispo Station*, M.C.Z.; *Pinagon Trail, below Camp Townsend*, A.M.N.H.)

VENEZUELA.—(*Aroa*, Mich.; *Caracas*, Boulenger, 1885, p. 364, A.N.S.P.; *Caraquito*, Fowler, 1913, p. 173, A.N.S.P.; *Chama*, A.M.N.H.; *Cochiwano*, A.M.N.H.; *Cumanacoa*, M.C.Z., Mich.; *Encontrados*, F.M.N.H.; *Esmeralda*, A.M.N.H.; *La Frio River*, Mich.; *La Guaira*, Stejneger, 1901, p. 184, U.S.N.M.; *Laguna de Tucacas*, Mich.; *Macuto*, F.M.N.H.; *Merida*, Boulenger, 1903, p. 481; *Milla near Merida*, A.M.N.H.; *Motalan*, Mich.; *Nirgua*, Mich.; *Palmasola*, Mich.; *Rio Chico*, Stejneger, 1901, p. 184, U.S.N.M.; *San Felipe*, Mich.; *San Juan de los Morros*, U.S.N.M.; *San Seliz*, Mich.; *Tucacas*, Mich.)

Habitat and Habits.—Surprisingly little has been recorded concerning the habitat and habits of this form. According to Stejneger (1901, p. 184) " It runs with great rapidity. During the halts, after its little darts, it has the habit of nervously patting one of its forefeet as if in a hurry to make another start." In Colombia, Ruthven

(1922, p. 63) found it to be "common on the lowlands all about the range (Santa Marta District), but not uncommon in the more open parts of the flood-plain forests at Valencia and Valle de Upar. Although a ground form, it readily climbs about in low bushes in search of food."

Affinities.—Although *murinus* is probably the least specialized, *lemniscatus* seems to be more nearly central in relation to the other forms of the *lemniscatus* group. Its possible evolution from *murinus* stock through, or in common with, *arubensis* will be discussed in the summary at the end of this section.

Lemiscatus is most closely allied to *nigricolor* from which it differs only in the possession of a less specialized color pattern. The relationship with *ocellifer* is not so close and will be discussed under that form.

CNEMIDOPHORUS LEMNISCATUS NIGRICOLOR (Peters)

BLACK RACE RUNNER

1873. *Cnemidophorus nigricolor* Peters, Sitz.-Ber. d. Ges. naturf. Freunde zu Berlin, p. 76 (type locality, "Insel Gruppe Los Rocques, im Norden von La Guayra, Venezuela"; 4 cotypes).—O'Shaughnessy, Zool. Rec. for 1874, vol. 11, 1876, p. 76.—Bocourt, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, p. 273 pl. 20*c*, figs. 3, 3*a*.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 364; Cat. Liz. British Mus., vol. 3, 1887, p. 505.—Cope, Trans. Amer. Philos. Soc., vol. 17, 1892, p. 30; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.—Gadow, Proc. Zool. Soc. London, 1906, p. 301.—Meek, Publ. Field Mus. Nat. Hist., zool. ser., vol. 7, 1910, p. 417 (part).—Ruthven, Occas. Pap. Mus. Zool. Univ. Mich., no. 143, 1923, p. 8, (all).—Werner, Zeitschr. f. wissensch. Zool., vol. 125, p. 537.

Diagnosis.—This form is like *lemniscatus* in most structural characters, differing chiefly in coloration. The ventral caudal plates are more often smooth in *nigrocolor*, and the back, although sometimes indistinctly spotted, is unstriped, usually nearly unicolor, and predominatingly grayish or blackish. Certain old adults on Los Roques are uniform dark brown above, instead of black.

Unlike certain *lemniscatus*, with which *nigricolor* is most likely to be confused, there is never a more or less distinct, wide, bluish or grayish middorsal band present. Instead the ground pattern of the back and sides of *nigricolor* is characteristically devoid of contrasts.

Nigricolor may be distinguished from *murinus* and *arubensis* by the absence of large, round, light spots on the sides and by the smaller size; in addition, it differs from the former of these, *murinus*, by the possession of 8 rows of ventral plates instead of 10 or 12.

Description.—Snout rather blunt to moderately pointed; nostril usually in suture between anterior and posterior nasals; anterior nasal not in contact with second upper labial; supraoculars 4;

supraocular granules usually not extending forward past the anterior border of the fourth supraocular; frontoparietals normally 2; parietals 5; anterior and posterior gulars usually poorly differentiated, rather small, often uniform, but sometimes with somewhat enlarged central and medio-lateral patches of granules; mesoptychials rather small to moderate; these uniform or largest centrally, in 2–5 rows, posterior not always largest; postmesoptychial granules minute, often overlapping the posterior edge of the second gular fold.

Body elongate, ventral plates in 8 longitudinal and 30–37 transverse rows; anal spurs often well developed; dorsal granules small; limbs well developed; brachials 2–8; antebrachials 1–2; brachials usually more or less continuous with antebrachials at a point of contact; postantebrachials granular or slightly enlarged; femorals 5–7; tibials 2–4; femoral pores 24–30; tail elongate, tapering, with moderately oblique, rather pointed caudal scales, these weakly keeled on the sides and somewhat irregular in arrangement with respect to the longitudinal; ventral caudals usually, although not always, smooth or very weakly keeled.

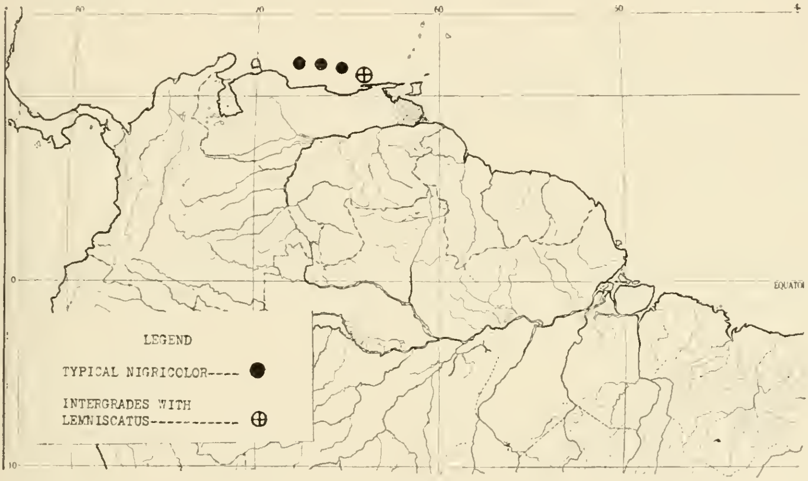

Figure 9.—Map showing locality records of Cnemidophorus lemniscatus nigricolor

The coloration is moderately variable. Lower surfaces white, yellowish, gray, slate, greenish, bluish or black; lower flanks often darker than median ventral region; tail white to blackish below, sometimes brownish, and above, darker but nearly unicolor; dorsal surface without well defined stripes, and usually without even traces of stripes; middorsal region unicolor, and either darker or lighter than the flanks, but not showing as a conspicuous, widened bluish or grayish blue band as in certain large individuals of *lemniscatus;*

dorsal ground color black, brown, gray, or slate; sides often with small flecks or spots.

A series of 42 specimens has been examined and the data may be summarized as follows: Body, 56–96 mm.; tail, 126–221; total length, 182–313; width of head, 7.0–16.5; hind leg, 35–62; supraocular granules extending forward to the middle of the fourth supraocular in 25 specimens, to the anterior border of the fourth supraocular in 15 specimens, and to the middle of the third supraocular in 2 specimens.

Variation.—Considerable geographical variation in color is evident in the populations of the various islands upon which *nigricolor* has been taken. On Aves Island the dorsal ground color is gray or blackish gray, but eastward on Los Roques it is always black or brownish. Still further eastward on Blanquilla Island the tone is again grayish, but with a little blue. This same variation is found south of this point on Margarita Island.

There is apparently no variation in bodily proportions or in the number of femoral pores. Also, all but the keeling of the ventral caudal scales seems to be relatively constant in regard to the scutellation. The ventral caudals, although showing variation in respect to the keeling, are usually smooth in the lizards on all of the islands mentioned above, except those on Margarita Island. This island lies near the mainland of South America, and hence closer to the present range of *lemniscatus*. Here the ventral caudals are noticeably keeled, but not as much as in the normal mainland specimens of *lemniscatus*. The coloration, too, is intermediate, the spots on the sides being larger than is usual in *nigricolor*, but smaller than is usual in *lemniscatus*. Therefore, the Margarita specimens (particularily F.M.N.H. No. 2682, series) are considered as intermediates, if not intergrades, between *nigricolor* and *lemniscatus*, and the populations, distinguished on slight variations only, are held to be in subspecific relation to each other.

A single, additional, median posterior frontoparietal is present in one of the specimens examined (Mich. 49800). This abnormality is also shown by the type specimen of *ruatanus* (*lemniscatus*).

Range.—The black race runner is known only from islands off the north coast of Venezuela. It occurs from the Aves Island east to Blanquilla Island and intergrades with *lemniscatus* through the population on Margarita Island, south of Blanquilla.

The available records are as follows:

DUTCH LEEWARD ISLANDS.—(*Aves Island*, Meek, 1910, p. 417, F.M.N.H.; *Los Roques Islands*, Peters, 1873, p. 76, F.M.N.H., M.C.Z., Mich.)

VENEZUELAN ISLANDS.—(*Blanquilla Island*, Meek, 1910, p. 417, F.M.N.H.; *Margarita Island*, Meek, 1910, p. 417, F.M.N.H.)

Habitat and habits.—Nothing is known concerning the habitat and habits of these lizards.

Affinities.—The black race runner is apparently a modified form of *lemniscatus*, to which it is most closely allied.

CNEMIDOPHORUS OCELLIFER (Spix)

BRAZILIAN RACE RUNNER

1825. *Tejus ocellifer* Spix,[6] Spec. Nov. Lacert. Bras., p. 23, pl. 25 (type locality, "Bahia," Brazil).—Boie, in Oken, Isis, 1826, p. 119.—Wagler, Nat. Syst. Amph., 1830, p. 154.—Schinz, Naturg. u. Abbild. Reptilien, 1833, p. 97.—Peters, Monatsb. Berlin Akad. Wissensch., 1877, p. 412.

1831. *Teyus ocellifer* Cuvier, Animal Kingdom, p. 22.—Griffith, Cuvier's Animal Kingdom, Class Reptilia, 1831, p. 114.—Gray, Synops. Reptilia, appx. to Griffith's Cuvier's Animal Kingdom, 1831, p. 29.

1861. *Cnemidophorus lacertoides var.* Reinhardt and Lütken, Vidensk. Meddel. nat. Foren., p. 146.

1861. *Cnemidophorus hygomi* Reinhardt and Lütken, Vidensk. Meddel. nat. Foren., p. 231 (type locality, "Marium," Brazil).—Bocourt, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, pp. 269, 273, pl. 20*c*, figs. 12, 12*a*-*b*.—Müller, Verhandl. Naturf. ges. Basel, vol. 7, 1885, p. 292.

1877. *Cnemidophorus ocellifer* Peters, Monatsber. Berlin Akad. Wissensch., p. 414.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 372; Cat. Liz. British Mus., vol. 2, 1887, p. 506.—Cope, Proc. Amer. Philos. Soc., vol. 24, 1887, p. 56.—Stejneger, Proc. U. S. Nat. Mus., vol. 12, 1890, p. 644.—Cope, Trans. Amer. Philos. Soc., vol. 17, 1892, p. 50.—Boettger, Kat. der Rept. Samml. im Mus. Senckenb. Naturforsch. Ges. in Frankfurt, teil 1, 1893, p. 75.—Peracca, Boll. Mus. Torino, vol. 10, no. 195, 1895, p. 6.—Koslowsky, Revista Mus. La Plata, vol. 8, p. 185.—Cope, Ann. Rpt. U. S. Nat. Mus. for 1898, 1900, p. 569.—Goeldi, Bol. Mus. Paraense, vol. 3, nos. 3, 4, 1902, pp. 537, 546.—Gadow, Proc. Zool. Soc. London, 1906, p. 301.—Bertoni, Fauna Paraguaya, 1913, p. 25.—Griffin, Ann. Carnegie Mus., vol. 11, 1917, p. 313.—Mueller, Abh. d. Senckenb. Naturf. Ges., vol. 40, 1927, p. 288.

1885. *Cnemidophorus lemniscatus* Boettger,[7] Zeitschr f. Naturwiss. Zool., vol. 58, p. 217.—Bertoni, Fauna Paraguaya, 1913, p. 25.

1897. *Cnemidophorus occellifer* Peracca, Boll. Mus. Torino, vol. 12, no. 274, p. 6.

Systematic notes.—The Brazilian race runner was described from Bahia, Brazil, by Spix (1825) as a species of *Teius.* Because of the presence of five well developed toes on the hind foot, instead of four, and because of the absence of a sheath between the posterior part of the scaly portion of the tongue and the larynx, the form has since been transferred to the genus *Cnemidophorus.*

Cnemidophorus hygomi was described by Reinhardt and Lütken in 1861 from Marium, Brazil. The differences cited in the diagnosis were from the southern *lacertoides*, which must now be placed in the genus *Ameiva*, instead of from the *ocellifer* of Spix, which was not mentioned. Since the specimens designated as *hygomi* apparently differ in no way from *ocellifer*, Boulenger (1885, p. 372) is followed in reducing the species to the synonymy of this form.

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[6] The original Latin diagnosis of this form is rather rare, and therefore is included here: "Minor, brunneo-olivaceous; hypochondriis serie bina ocellatis; taenia utrinque tenui alba a dorso laterali usque ad dimidiam caudam; scutello occipitali intermedio rectangulo, supra anum unico."

[7] According to the same author (Boettger, 1893, p. 75) this report (Paraguay) should be referred to *C. ocellifer.* The writer is at present unable to do more than synonymize the name as indicated, and this seems reasonable since the range of *lemniscatus* is far removed from Paraguay.

Diagnosis.—This distinct species may be readily recognized by the following characters: parietals 5; supraoculars normally 4; supraocular granules usually extending forward past the anterior border of the third supraocular; femoral pores 7–12; ventral caudals keeled or ridged as in *lemniscatus;* anal spurs not developed; size always small.

Description.—Snout moderately pointed; nostril usually in suture between anterior and posterior nasal plates; anterior nasal not in contact with second upper labial; supraoculars normally 4; supraocular granules usually extending forward to or past the middle of the second supraocular, rarely just reaching the posterior border; frontoparietals normally 2; parietals 5; anterior and posterior gulars often poorly differentiated, but graded and smaller posteriorly; anterior gulars usually with a pair of enlarged baskets of scutes laterally, and at times a smaller one medially; mesoptychials moderately large, largest medio-laterally or at a point just to the side of the median line, smaller toward sides, in 1–4 rows, posterior usually largest; postmesoptychial granules minute, rarely extending to the edge of the posterior gular fold, except at the median line.

Body elongate; ventral plates in eight longitudinal rows, external ones sometimes reduced, and in 26–33 transverse rows; dorsal granules small; limbs well developed; brachials 3–5; antebrachials 2–3; brachials usually continuous with antebrachials at a point of contact; postantebrachials granular or slightly enlarged; femorals 4–6; tibials 2–3; femoral pores 7–12; tail elongate, tapering, with moderate, oblique scales; caudals keels moderate, more or less irregularly arranged on sides, but forming continuous longitudinal ridges below.

The coloration is moderately variable. Lower surfaces white, yellowish, or light blue; lower flanks bright blue, deeper colored than the median ventral plates; tail white or yellowish below, apparently even in the young; tail brownish or olivaceous above, often more or less spotted with dark brown; two more or less distinct lateral stripes may be continued from each side of the body to the tail; femora usually more or less spotted and reticulated with white above, line behind; ground color above brownish, blue-gray, gray, blue-black or reddish, often varied in each of the three major fields, lower darkest, middorsal lightest; pattern distinct in young, but sometimes much faded in adults; sides with two distinct light lines, between these a dark field in which a single row of small, round spots appears; a pair of faint dorsal stripes present in smaller specimens, these often more or less wavy; mid-dorsal field between these stripes often very light, reminding one of *sexlineatus*, dorsolateral field darker, but not as dark as lateral field; upper fields unspotted; old specimens often nearly unicolor, but traces of the dark lateral fields and the round light spots still remain on the sides.

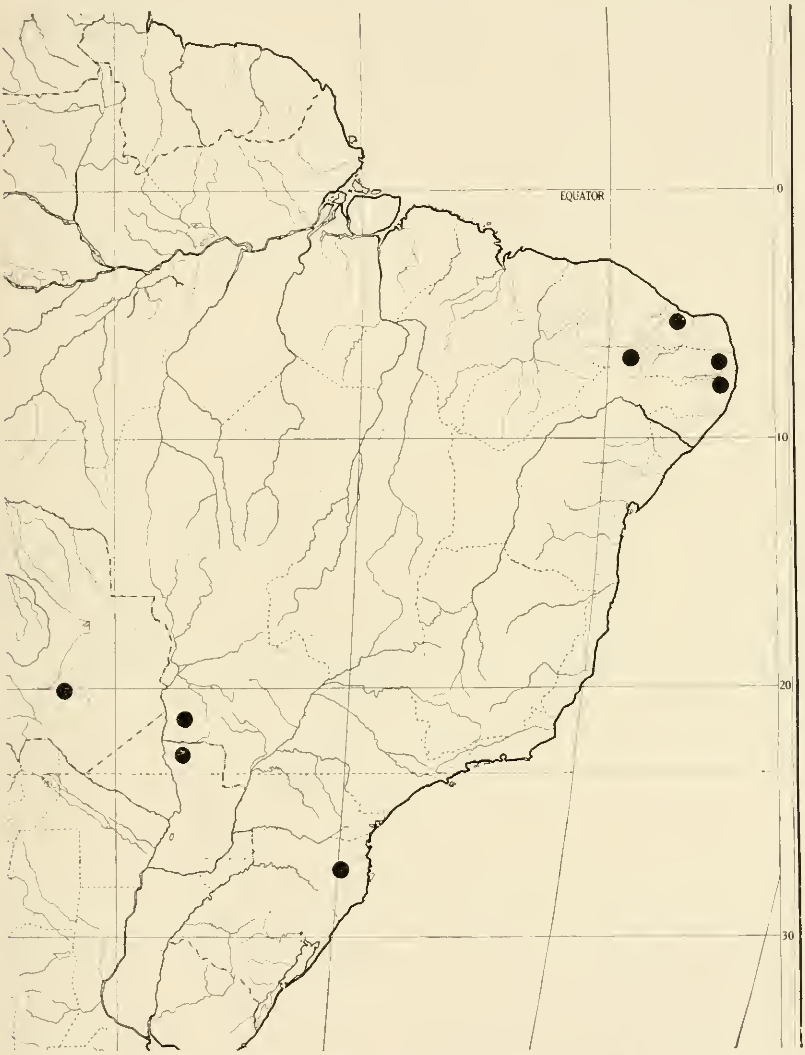

FIGURE 10.—MAP SHOWING LOCALITY RECORDS OF CNEMIDOPHORUS OCELLIFER

A series of 65 specimens of *ocellifer* has been examined. Data secured from these may be summarized as follows: Body, 32–83 mm.; tail, 63–150; total length, 134–238; width of head, 4.5–13.5; hind leg, 21–49; supraoculars 4 in 64 specimens, and 3 in 1 specimen; parietals 5 in all specimens; supraocular granules extending forward to the posterior border of the second supraocular in 1 specimen, to the middle of the second supraocular in 6 specimens, and to the anterior border of the second supraocular in 58 specimens.

Range.—This lizard is known only from Bolivia, Brazil, and Paraguay. The few available records of its occurrence are listed below.

BOLIVIA.—(*Caiza*, Peracca, 1897, p, 6.)

BRAZIL.—(*Bahia*, Spix, 1825, p. 23, A.M.N.H.; *Baixo Verde*, C.A.S.; *Ceara*, C.A.S.; *Fortaleza*, C.A.S.; *Independencia*, C.A.S.; *Joazeiro*, Carnegie; *Marium*, Reinhardt and Lütken, 1861, p. 146; *Matto Grosso*, Cope, 1887, p. 56; *Natal*, C.A.S.; *Parahyba River*, C.A.S.; *Pernambuco*, Müller, 1927, p. 288; *Quixada*, C.A.S.; *Rio Puty*, M.C.Z.; *Rio San Francisco*, Griffin, 1917, p. 313.)

PARAGUAY.—(*Colonia Risso*, *Rio Apa*, Peracca, 1895, p. 6.)

Habitat and habits.—Apparently nothing is known about this subject.

Affinities.—As a species of *Cnemidophorus*, the Brazilian race runner is evidently most closely related to the geographically adjacent *lemniscatus*. It is very well differentiated from that form, however, having from 7 to 12 femoral pores instead of from 15 to 29, a smaller size, no preanal spurs, and a different coloration. It is like *lemniscatus* in the cephalic scutellation, with the exception that the supraocular granules usually extend much farther forward. It also agrees with *lemniscatus* in the character of the tongue, in the number of ventral plates, in the keeling of the subcaudals, and in the position of the nasal opening.

CNEMIDOPHORUS MURINUS MURINUS (Laurenti)

TARAGUIRA

1768. *Seps murinus* Laurenti, Synops. Reptil., p. 63, (type locality, "Guiana").—Gmelin, Syst. Nat., vol. 3 of ed. 13, 1789, p. 102.—Wagler, Nat. Syst. Amph., 1930, p. 154.—Schinz, Naturg. u. Abbild. Reptilien, 1833, p. 97.—Sherborn, Index Animalium (1758–1800), 1902, p. 637.—Brown, Proc. Acad. Nat. Sci. Phila., vol. 60, 1908, p. 118.

1802. *Lacerta caeruleo-cephala* Sonnini and Latreille, Hist. Nat. Reptiles, vol. 1, p. 242, (part).

1802. *Laecrta ameiva* Daudin, Hist. nat. Reptiles, vol. 3, p. 98, (part).

1820. *Teius cyaneus* Merrem, Syst. Amph., p. 61 (part).

1826. *Ameiva murina* Fitzinger, Neue Classif. der Reptilien, p. 51.

1834. *Cnemidophorus murinus* Wiegmann, Herpetologia Mexicana, p. 27.—Duméril and Bibron, Erp. Gén., 1839, p. 126.—Fitzinger, Syst. Reptilium, 1843, p. 20.—Gray, Cat. Liz. Brit. Mus., 1845, p. 21.—Berthold, Mitt. Zool. Mus. Göttingen, vol. 1, 1846, p. 13.—Duméril and Duméril, Cat. méth. Coll. Reptiles, Paris, 1851, p. 116.—Lichtenstein, Nomenclator

Berol., 1856, p. 13.—JAN, Indice Sist. dei Rett. ed Anfibi Mus. Civ. di Milano, 1857, p. 40.—COPE, Proc. Acad. Nat. Sci Phila., 1862, p. 356.—REINHARDT and LÜTKEN, Vidensk. Meddel. nat. Foren, 1862, p. 168.—COPE, Proc. Amer. Philos. Soc., vol. 11, 1869, p. 158.—WESTPHAL-CASTELNAU, C. R. trav. Cong. sci. de France, tenu a Montpellier en dec. 1868, 1870, p. 19.—BOCOURT, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, pp. 269, 273, pl. 20c, figs. 1, 1a–d.—PETERS, Monatsb. Berlin Akad. Wissensch., 1877, p. 412.—BOULENGER, Cat. Liz. British Mus., vol. 2., 1885, p. 361.—COPE, Trans. Amer. Philos. Soc., vol. 17, 1892, p. 30; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.—WERNER, Verhandl. zool.-bot. Ges. Wien, 1900, p. 266.—HARTERET, Novitates Zoologicae (Tring Mus.), vol. 9, 1902, p. 294.—LOENNBERG, Bihang till K. Svenska Vet.-Akad. Handl., vol. 28, 1902, p. 28.—VAN LIDTH DE JEUDE, Notes Leyden Mus., vol. 25, 1904, p. 89.—GADOW, Proc. Zool. Soc. London, 1906, p. 301.—MEEK, Publ. Field Mus. Nat. Hist., zool. ser., vol. 7, 1910, p. 417.—BARBOUR, Mem. Mus. Comp. Zöol., vol. 44, 1914, p. 218.—ROOIJ, Bijdragen tot de Dierkunde (Feest Nummer . . . . van Dr. Max Weber), vol. 22, 1922, pp. 249, 252.—RUTHVEN, Occas. Pap. Mus. Zool. Univ. Mich., no. 143, 1923, p. 8.—WERNER, Zeitschr. wissensch. Zool., vol., 125, 1925, p. 537.

1838. *Ameiva guttata* GRAY, Ann. and Mag. Nat. Hist., ser. 1, vol 1, p. 277, (type locality, unknown).

1885. *Cnemidophorus murinus* (part) COPE, Proc. Amer. Philos. Soc., vol. 22, pp. 181–182.

1899. *Cnemidophorus minimus* COPE, Sci. Bull. Phila. Museums, vol. 1, p. 9, (*lapsus calamus*).

1925. *Cnemidophorus arubensis* WERNER, Zeitschr. f. wissensch. Zool., vol. 125, pp. 537, 545, (part).

1925. *Cnemidophorus murinus murinus* BURT *and* BURT, Proc. U. S. Nat. Mus., vol. 78, art. 6, 1930, p. 31.

Systematic notes.—Like *lemniscatus*, *murinus* was figured by Seba.[8] Thus, it is one of the oldest known forms of *Cnemidophorus*. It was overlooked by Linnaeus, but was given the name, *Seps murinus*, by Laurenti (1768), who described it from "Guiana." In the period just after this *murinus* was more or less confused with *lemniscatus*, and was not given position as a species of *Cnemidophorus* until the appearance of the work of Wiegmann in 1834.

Ameiva guttata was described by Gray in 1838 from an unknown locality. At this time the distinctions between *Ameiva* and *Cnemidophorus* were very imperfectly known and it is not surprising that a specimen of *murinus* should, on account of its large size and general appearance, have been placed in the genus *Ameiva*. It is fairly certain that the type was of the present species because "*Seps murinus* Laur." was listed as a full synonym of *guttata* in the original description, which read as follows. "Olive-green; sides darker, with 6 or 7 cross-rows of 3–4 large white spotes; abdominal plates 10-rowed * * * Our specimen is bleached." Still, it appears that in spite of the fact that *murinus* was included originally in the synonymy of *guttata*, the species might as well have been based on a spotted example of *Ameiva ameiva ameiva*.

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[8] Vol. 2, 1735, pl. 105, fig. 2.

Diagnosis.—This species is readily determined because it is the only form of *Cnemidophorus* which has from 10 to 12 longitudinal series of large ventral plates. Otherwise *murinus* is very close to *arubensis*.

Description.—Snout rather blunt to moderately pointed; nostril usually in suture between anterior and posterior nasal plates; anterior nasal not in contact with second upper ladial; supraoculars normally 4; supraocular granules usually not extending forward past the center of the third supraocular; frontoparietals normally 2; parietals normally 5; interparietal often divided longitudinally, in certain regions; anterior and posterior gulars usually poorly differentiated, rather small, often uniform, but sometimes with slight central and medio-lateral enlargements or baskets; mesoptychials moderate, uniform or slightly enlarged centrally, smaller toward the extreme lateral edges, in 2–6 rows, posterior not always largest; postmesoptychial granules minute, usually extending forward over the edge of the posterior gular fold for its entire length.

Body elongate; ventral plates in 10–12 (outer sometimes reduced) longitudinal and 35–42 transverse series; anal spurs often well developed; dorsal granules minute; limbs well developed; brachials small, without enlarged series; antebrachials also unusually small, in 1–2 rows, surrounded by small lateral granules; brachials separated from antebrachials by a series of connecting granules; postantebrachium covered with granules; postbrachium often with a decidedly enlarged patch of granules; femorals 8–13; tibials 3–5; femoral pores 27–45; tail elongate, tapering, with many caudal plates as in *Ameiva ameiva ameiva;* lateral caudals slightly oblique, smooth or weakly keeled; if keeled, keels not arranged in perfect longitudinal series; ventral caudals smooth near base of tail, but usually slightly keeled toward the tip.

The coloration is relatively constant. Lower surfaces white, yellowish, slate or blackish; lower flanks usually grayish or blue and deeper colored than median ventral plates; tail, white to slaty below, sometimes suffused with blue, above brownish, gray or olivaceous, seldom blackish; young sometimes with indications of 4–7 stripes on the back as often found in *arubensis;* adult unlined; sides of young often reticulated or obscurely spotted on a ground color of brownish, grayish, blackish, or slate, which is often suffused with blue; adults always with series of large, round, light spots on the sides, these in roughly transverse arrangement; spots white or blue, except in melanistic specimens; back of all specimens unspotted in the mid region.

A series of 70 specimens of *murinus* has been examined. Data on these are as follows: Body, 42–147 mm.; tail, 122–310; total length, 164–448; width of head, 7–23; hind leg, 36–95; supraoculars 4–5 in 1 specimen, four in 68 specimens, and 3–4 in 1 specimen; supraocular granules extending forward to the anterior border of the fourth supraocular in 53 specimens, and to the middle of the third supraocular in 17 specimens; frontoparietals four in 3 specimens, and two in 67 specimens; parietals six in 13 specimens, and five in 57 specimens.

Variation.—There is apparently a sexual dimorphism in the development of the anal spurs of this lizard. Old males have these spurs well developed, while spurs in the females and young are in a rudimentary condition or are entirely absent.

Specimens from Curaçao are decidedly more like *arubensis* than those from Bonaire, and these two populations are almost distinct enough to be given recognition as separate forms on the basis of a difference in the femoral pores.

The appearance of faint dorsal stripes has been observed only in a few young specimens from Curaçao and this suggests transition from the typical unicolor condition of the young on Bonaire to the more definite sort of striping usually seen in the young of *arubensis*. The population on Curaçao seems to be on the whole less melanistic than that on Bonaire, but lighter colored specimens are found on both islands. Therefore, the colorational differences do not seem to be sufficient to serve as a basis of separation here.

The range in the number of femoral pores for 43 specimens from Curaçao is from 27 to 35, only one having the latter number. The range for 19 specimens from Bonaire is from 31 to 44, only two having less than 36 femoral pores. This gives an overlapping of 12.9 per cent and with the accumulation of more specimens this figure will no doubt be either increased or reduced. If it is decidedly reduced, and if *murinus* is restricted to these islands, a new subspecies may then be described from either Curaçao or Bonaire. After this, the validity of the suggested new form may be impaired by the finding of a trifle more variation in the size of the external longitudinal rows of ventral plates of certain specimens of *murinus* (on Curaçao) or of *arubensis*.

Duméril and Bibron (1839, p. 126) listed *murinus* as having 18 longitudinal series of ventral plates, but the "18" is no doubt a typographical error for "10" or "12."

Range.—There is considerable question as to the actual distribution of *murinus*. All of the specimens with unquestionable locality data examined by the writer are from Curaçao and Bonaire in the Dutch Leeward Islands off the northern coast of Venezuela. Because of this and since there is the possibility of confusion with *lemniscatus* on the basis of general appearance, or even with *Ameiva ameiva ameiva* on the basis of the increased number of ventral plates (10–12) and the spots on the sides, the mainland reports of this lizard are not given full credence here. In support of this action, it may be stated that the writer has examined the many South American specimens of both *Ameiva* and *Cnemidophorus* in the leading American museums, and finds them all to differ from *murinus*.

The type locality of *murinus* which was given as "Guiana," may, as indicated above, be an error. Werner (1900, p. 266) reported as *murinus*, a specimen said to have been collected at Puerto Cabello, Venezuela, and Van Lidth de Jeude (1904, p. 89) one from Gonini, Surinam. As already surmised, these, and likewise the record from the Bartica District of British Guiana given by Beebe (1919, p. 212) may have been based on either *Cnemidophorus lemniscatus lemniscatus* or *Ameiva ameiva ameiva*. Rooij (1922, p. 252) listed a specimen from Caracas Bay as *Cnemidophorus murinus*, but most of her specimens were from Curaçao. Her "Jan Tiel" report is assumed to have been from Curaçao, since she lists the measurements of a specimen from there.

A specimen in the American Museum of Natural History (No. 630) was labeled as from "Guiana, South America" and another in the same collection (No. 28404) simply as from "Venezuela." These indefinite reports may be held to indicate that *murinus* may occur on the mainland, as do the records cited from the literature, and only the future work of herpetologists can definitely settle this point.

The occurrence of *murinus* on Curaçao and Bonaire may be summarized as follows:

BONAIRE.—(*General Report*, Meek, 1910, p. 417, Mich., F.M.N.H.; *Klein Bonaire Island*, Ruthven, 1923, p. 8, Mich.; *Pos Frances*, Ruthven, 1923, 8, Mich.; *Santa Barbarco, beyond El Hato*, Ruthven, 1923, p. 8, Mich.; *Seroe Grandi, near Playa Makosji*, Ruthven, 1923, p. 8, Mich.; *Seroe Grandi, 4½ miles northwest of Kralendijk*, Ruthven, 1923, p. 8, Mich.; *Seroe Wassau*, Ruthven, 1923, p. 8, Mich.).

CURAÇAO.—(*General Report*, Cope, 1885, p. 182, Mich., U.S.N.M.; *Klein Curaçao*, Ruthven, 1923, p. 8, Mich.; *6 miles west of entrance to Laguna, near Willembrodus*, Mich.; *North side of Ronde Klip*, Mich.; *Scharloo, Mich.*).

Habitat and Habits.—Nothing is known concerning the habitat of this form and the following note from Loennberg (1902, p. 28) pertaining to its food, is apparently all that is known about its habits: "One stomach contained the remains of a beetle, otherwise only vegetable matter, mostly unbroken leaflets supposed to have belonged to some leguminous plant, a couple of rather large dark bean-like seeds and a piece of some plant containing a lot of crystals of oxalate."

Affinities.—This species is very probably the most primitive modern form of the genus *Cnemidophorus.* In the greater number of caudal plates, the small size of the brachials, the presence of a patch of enlarged postbrachials, the higher number of longitudinal rows of ventral plates, the presence of five parietal shields, the retention of a vestigial sheath between the larynx and the posterior tips of the scaly portion of the tongue, and in the spotted pattern of the adult, it is like *Ameiva ameiva ameiva* of the neighboring South American mainland. However, *murinus* is specialized from *Ameiva ameiva ameiva* in its smaller maximum size, higher average number of femoral pores, reduced lingual sheath, and in the presence of well developed anal spurs in some specimens. Thus, it is seen that *murinus* shows a transition from *Ameiva* to *Cnemidophorus* in many ways, including the character of the tongue. It serves as a link, apparently, between the prototypic *Ameiva ameiva ameiva* on the mainland (which is probably the nearest modern approach to the ancestral Teiid stock which gave rise to *murinus*) and the other species of *Cnemidophorus.* This subject will be elaborated in the general summary at the end of this work (pp. 251–260).

As shown by Ruthven (1923, p. 8), *murinus* resembles *arubensis* in coloration. It differs chiefly in the increased number of longitudinal rows of ventral plates, having 10 or 12 large series instead of 8. There is apparently little doubt that this geographically adjacent *arubensis* has arisen from *murinus*, presumably since its isolation on Aruba.

Murinus is apparently related to the smaller, much modified *lemniscatus* only indirectly and through *arubensis*, but there is the bare possibility that the two were once connected by an ancient common stock.

CNEMIDOPHORUS MURINUS ARUBENSIS (Van Lidth de Jeude)

BLAUSANA

1887. *Cnemidophorus arubensis* Van Lidth de Jeude, Notes from the Leyden Mus., vol. 9, p. 132 (type locality, "Aruba," Dutch West Indies).—Boulenger, Zool. Rec. for 1887, vol. 24, "Reptilia," 1888, p. 11; Proc. Zool. Soc. London, 1894, p. 724.—Hartert, Novitates Zoologicae (Tring Mus.), vol. 9, 1902, p. 294.—Gadow, Proc. Zool. Soc. London, 1906, p. 301.—Rooij, Bijdragen tot de Dierkunde (Feest Nummer. . . van Dr. Max Weber), vol. 22, 1922, pp. 249, 252.—Ruthven, Occas. Pap. Mus. Zool. Univ. Mich., no. 143, 1923, p. 8.—Werner, Zeitsch. f. wissensch. Zool., vol. 125, 1925, pp. 537, 545 (part).

1910. *Cnemidophorus nigricolor* Meek, Publ. Field Mus. Nat. Hist., zool. ser., vol. 7, p. 417 (part).

Diagnosis.—The blausana is intermediate between *murinus* and *lemniscatus.* From *murinus* it is distinguished by its reduced number of full-sized ventral plates, having 8 instead of 10 or 12. It differs from *lemniscatus* in having a series of 27 or more femoral pores on each thigh instead of less than 27.[9] Also, the spots on the sides are smaller and usually more numerous in adult males of *lemniscatus*. The lower sides of young *arubensis* are spotted, those of young *lemniscatus*, unspotted. The dorsum of *arubensis* may be either lined or unlined; if lined, the ground color is usually brownish and the lines are wider and more poorly defined than is usual in *lemniscatus*.

Description.—Snout moderately pointed; nostril usually in suture between anterior and posterior nasal plates; anterior nasal not in contact with second upper labial; supraoculars normally 4; supraocular granules usually not extending forward past the anterior border of the fourth supraocular; frontoparietals normally 2; parietals normally 5; anterior and posterior gulars often poorly differentiated, rather small behind, larger in front; anterior gulars often with enlarged central and medio-lateral patches of granules; mesoptychials moderate, uniform or graded so as to be slightly enlarged centrally and smaller toward the extreme lateral edges, in 2–6 rows, posterior not always largest; postmesoptychial granules minute, usually extending forward over the edge of the posterior gular fold.

Body elongate; ventral plates in 8 (a vestigial outer pair sometimes present in addition) large longitudinal series and in 35–42 transverse rows; anal spurs often well developed; dorsal granules small; limbs well developed; brachials small, one row larger; antebrachials 2–3; brachials often in contact with antebrachials, but usually separated from them by granules; postantebrachials granular; postbrachials enlarged, but in continuous series with brachials; femorals 7–12; tibials 2–4; femoral pores 27–33; tail elongate, tapering, with fewer caudal plates than in *murinus;* ventral caudals smooth or weakly keeled; lateral caudals oblique, with more or less continuous longitudinal keels.

Coloration moderately variable; lower surfaces white, bluish, or slaty; lower flanks usually darker than median ventral plates; tail brownish, bluish, or olivaceous; dorsal ground color brownish, bluish or blackish; sides always with many large round blue spots arranged in more or less regular transverse rows; back of young and females often with four or more widened, often poorly defined, light lines which tend to disappear with age; old males without lines; spots of unlined adults usually extending higher on back than those of *murinus*.

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[9] A single specimen from British Guiana (*lemniscatus*) was reported by Ruthven (1915*a*) as having 29 femoral pores.

A series of 25 specimens has been examined and the data summarized as follows: Body, 42–110 mm.; tail, 95–252; total length, 137–353; width of head, 6–16; hind leg, 35–78; supraoculars four in 23 specimens, five in 1 specimen, and 5–6 in 1 specimen; supraocular granules extending forward to the middle of the fourth supraocular in 1 specimen, and to the anterior border of the fourth supraocular in 23 specimens, and to the middle of the third supraocular in 1 specimen.

Range.—The blausana is evidently confined to the island of Aruba in the Dutch Leeward Islands off the northwestern coast of Venezuela. The available records are as follows: (*General Report*, Van Lidth de Jeude, 1887, p. 132, F.M.N.H.; *Boedoei*, Ruthven, 1923, p. 8, Mich.; *Campo West Punt*, Ruthven, 1923, p. 8, Mich.; *North of Oranjestad*, Ruthven, 1923, p. 8, Mich.; *Near Perkietenbosch*, Ruthven, 1923, p. 8, Mich.; *Rooi Lamoenchi*, Ruthven, 1923, p. 8, Mich.)

Habitat and Habits.—Apparently nothing is known about the habitat and habits of this form.

Affinities.—As remarked by Van Lidth de Jeude (1887), "This species shows a great resemblance on one side with *murinus* and on the other side with *lemniscatus*. It agrees with *lemniscatus* in having eight longitudinal rows of ventral plates; as to coloration, it resembles *murinus*." However, in addition to the usual eight rows, a vestigial outer pair is sometimes present, approaching the condition shown by certain 10-ventralled specimens of *murinus* in which the outer rows are found to be somewhat reduced. Thus, the transition from *murinus* to *arubensis* is gradual, rather than abrupt as it would appear at first sight. Although the coloration resembles *murinus*, the development of the striped pattern in *arubensis* definitely points toward *lemniscatus*, as does likewise the enlargement of the brachial plates, the reduction in the number of femoral pores, and the more profuse spotting. Therefore, it appears that *arubensis* serves as a connecting link between *murinus* and *lemniscatus*, and for reasons to be presented in the general summary at the end of this work (pp. 251 to 260), it is thought to have been derived from the former.

SUMMARY OF THE LEMNISCATUS GROUP

The *lemniscatus* group is confined to Central and South America. The series as a whole is separated from other groups within the genus *Cnemidophorus* by the possession of five parietal plates and by the usual presence of the nostril in the suture between the anterior and posterior nasal plates instead of anterior to that suture.

The *lemniscatus* group is composed of five forms, *murinus*, *arubensis*, *lemniscatus*, *nigricolor* and *ocellifer*. As shown above (p. 51), *murinus*, the race runner on Bonaire and Curaçao, is very probably the most primitive modern form of *Cnemidophorus*. In characters it is intermediate between the other species of the genus and *Ameiva ameiva ameiva* of the mainland of South America, although presenting certain specializations from *Ameiva* that are such as to indicate the former existence of an intermediate ancestral type between the two genera. A full discussion of these relationships is given under the affinities of *murinus* (p. 51) and in the general discussion at the end of this work (pp. 251–260).

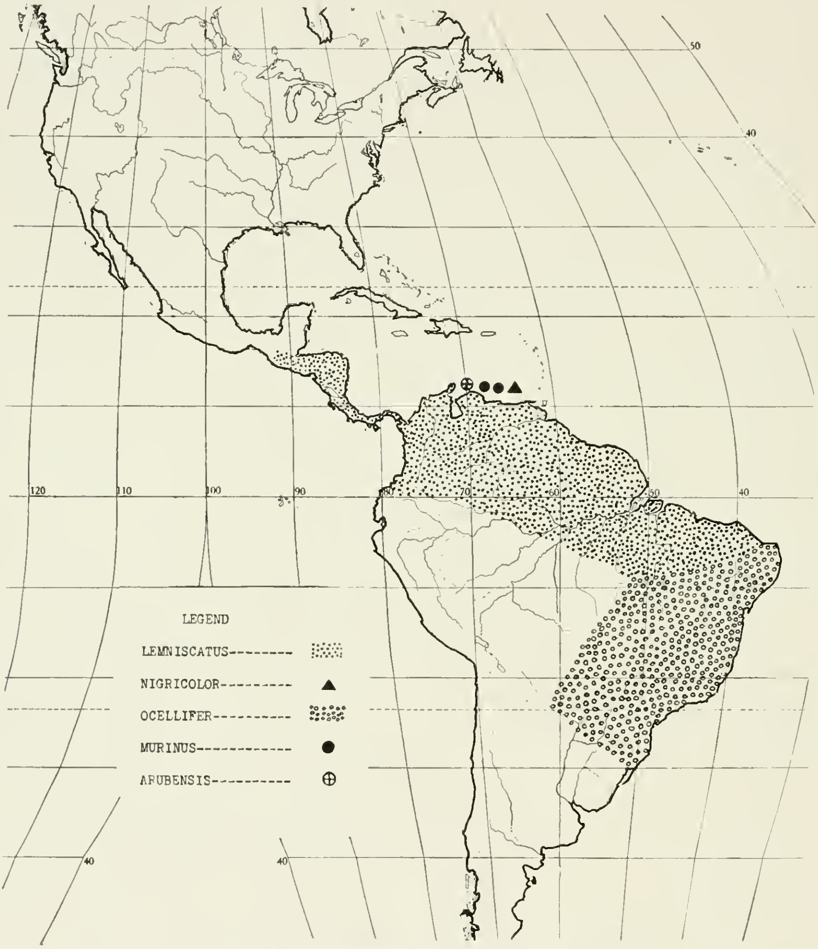

Figure 11.—Map showing distribution of forms of lemniscatus group

Arubensis of Aruba Island is intermediate, both in geographical position and in characters, between the insular *murinus* and the mainland *lemniscatus*. Its brachial scutellation is much coarser than that of typical *murinus* but much finer than that of typical *lemnis-*

catus, and its longitudinal rows of ventral plates are reduced to eight, from the 10 to 12 ventralled condition of *murinus*, as are those of all of the remaining species of *Cnemidophorus*. The range in the number of femoral pores for *murinus* has been found to be from 27 to 45, for *arubensis* 27 to 33, and for *lemniscatus* from 15 to 29; thus, again, *arubensis* is transitional. The pattern of *murinus* consists essentially of a uniform dorsal ground color, broken only by large, round, white spots on the sides, although a few young specimens from Curaçao, which is geographically adjacent to Aruba, show the suppression of lateral spots and the assumption of more or less distinct dorsal stripes as do juveniles of *arubensis*. This process proceeds so far in *arubensis* that the adult females are often found with stripes and from these to the perfectly striped young of *lemniscatus* is but a step. The latter form often reverts to the spotted, unlined, condition in the adult male, developing enlarged blue spots of the sides and at times approaching adult *arubensis* in general appearance. Also, the largest adults of *lemniscatus* are smaller than adults of *arubensis* and *murinus*, and the additional derivatives, *nigricolor* and *ocellifer*, are even smaller than specimens of *lemniscatus*.

Lemniscatus is central in relation to the other forms of its group and, as a wide-ranging, plastic entity, has had ample opportunity to give rise to other forms. It is found from Guatemala in the north to northern Brazil in the south. In Brazil its stock has evidently given rise to *ocellifer*, which has been rendered very distinct by a marked reduction in the number of femoral pores. These openings have changed from a minimum of 15 in *lemniscatus* to a maximum of 12 in *ocellifer*. The supraocular granules are also modified in *ocellifer*, extending much farther forward than in *lemniscatus*.

In the island arc just north of Venezuela, extending from Aves Island just east of Bonaire to Margarita Island, *nigricolor* has presumably risen from *lemniscatus*, possibly being derived after isolation by partial submergence of the general area. Subsequent submergence has then, perhaps, isolated the modern island populations of *nigricolor* from each other. The transition from *lemniscatus* to *nigricolor* is still shown by intermediate specimens on Margarita Island which tend to lose all stripes at a very early age and to have the rounded spots on the sides reduced in size. With the exception of an average diminution in the keeling of the subcaudal scales in *nigricolor*, the form is structurally practically identical with *lemniscatus*.

It may be said here that the break in relationships shown between the lizards on Bonaire (*murinus*) and Aves Islands (*nigricolor*), whose habitats are geographically adjacent, may be due to an ancient rift between these two points.

The preservation of the primitive types, *murinus* and *arubensis*, on islands, instead of on the mainland, is not without precedent. It may be explained by the theory that the ancestral *murinus* stock was once a mainland type, but that with topographical changes in the region north of Venezuela, this stock was isolated on the islands, Bonaire, Curaçao, and Aruba, while on the mainland is was changed to the progressive ancestral *lemniscatus* stock. Since Bonaire is farthest from the mainland, it was probably isolated first, and it is not surprising that the presumably least specialized modern group of individuals is to be found here. Before the isolation of Curaçao and Aruba, the ancestral *murinus* stock apparently became modified toward *lemniscatus* and this, if true, will account for the present transitional nature of these particular insular populations.

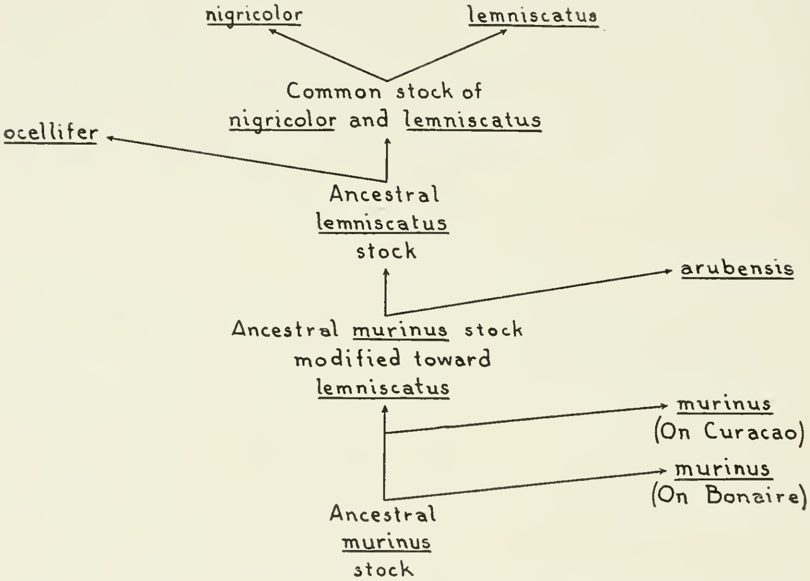
nigricolor
lemniscatus
Common stock of nigricolor and lemniscatus
ocellifer
Ancestral lemniscatus stock
arubensis
Ancestral murinus stock modified toward lemniscatus
murinus (On Curacao)
murinus (On Bonaire)
Ancestral murinus stock

Figure 12.—Diagram of the supposed relationships within the lemniscatus group

The writer's interpretations of the genetic relationships within the lemniscatus group are expressed by the foregoing diagram.

THE DEPPII GROUP

CNEMIDOPHORUS DEPPII DEPPII (Wiegmann)

MANY-LINED RACE-RUNNER

1834. *Cnemidophorus deppii* Wiegmann, Herpetologia Mexicanna, p. 29, (type locality, "Mexico").—Gray, Cat. Liz. British Mus., 1845, p. 22.—Bocourt, Miss. Sci. Mex. et Amer. Cent., vol. 3, 1874, p. 281, pl. 20*c*, figs. 5, 5*a-d*; pl. 20*d*, figs. 1, 1*a-b*.—O'Shaughnessy, Zool. Rec. for 1878, vol. 15, 1880, "Reptilia", p. 7.—Sumichrast, La Naturaleza, ser. 1, vol. 6, 1884, p. 39.—Garman, Bull. Essex Inst., vol. 16, 1884, p. 13.—Boulenger Cat. Liz.

British Mus., vol. 2, 1885, p. 371.—Günther, Reptilia and Batr., in Biol. Centr.-Amer., 1885, p. 27.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—Atkinson, Ohio Nat., vol. 7, 1907, p. 155.—Ruthven, Zool. Jahrb., vol. 32, 1912, p. 322.—Schmidt, Publ. Field Mus. Nat. Hist., Zool. Ser., vol. 12, 1928, p. 198.—Mertens, Abhandl. u. Ber. Mus. f. Naturw. Ver. Magdeburg, vol. 6, 1930, p. 158.

1860. *Cnemidophorus decemlineatus* Hallowell, Proc. Acad. Nat. Sci. Phila., p. 482, (type locality, "Nicaragua"; 12 co-types, U. S. Nat. Mus. No. 6058; C. Wright, collector).—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 360.

1863. *Cnemidophorus deppei* Cope, Proc. Acad. Nat. Sci. Phila., p. 104.—Peters, Monatsb. d. Konigl. Akad. Wiss. Berlin, 1869, p. 63.—Günther, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—Sumichrast, Bull. Soc. zool. de France, vol. 5, 1880, p. 177.—Fischer, Oster-Progr. Akad. Gymn. Hamburg, 1883, p. 2.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.—Gadow, Proc. Roy. Soc. London, vol. 72, 1903, p. 113; Science, vol. 22, 1905, p. 638; Proc. Zool. Soc. London, 1905, p. 195; Proc. Zool. Soc. London, 1906, p. 309; Through Southern Mexico, Witherby and Co., 1908, pp. 139, 166, 181, 234; Zool. Jahrb., vol. 29, 1910, p. 703.—Ruthven, Rept. Mich. Acad. Sci., vol. 14, 1912, p. 231.

1877. *Cnemidophorus lativittis* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 94, (type locality, "Tuchitan, Tehuantepec," Oaxaca, Mexico; type specimen, U.S.N.M. No. 30227; F. Sumichrast, collector); Proc. Amer. Philos. Soc., vol. 18, 1879, p. 270.—O'Shaughnessy, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—Sumichrast, Bull. Soc. zool. de France, vol. 5, 1880, pp. 163, 177.

1877. *Cnemidophorus lineatissimus* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 94 (type locality, "Colima and Guadalaxara," Mexico; 20 cotypes, U.S.N.M. Nos. 24937–24940, 32299–32314; Mr. Hoge, collector).—O'Shaughnessy, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—Günther, Reptilia and Batr., in "Biol. Cent.-Amer.," 1885, p. 27.

1892. *Cnemidophorus deppei deppei* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 31.—Burt, Proc. Biol. Soc. Wash., vol. 42, 1929, p. 154.

1892. *Cnemidophorus deppei decemlineatus* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 31.

1892. *Cnemidophorus deppei lineatissimus* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 31; Amer. Nat., vol. 30, 1896, p. 1024; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 1232.

1894. *Cnemidophorus alfaronis* Cope, Proc. Acad. Nat. Sci. Phila., p. 199 (type locality, "San Mateo, Costa Rica"; type specimen, A.M.N.H. No. 16315; A. Alfaro, collector).—Boulenger, Zool. Rec. for 1894, vol. 31, 1895, "Reptilia," p. 23.

1897. *Cnemidophorus deppii lineatissimus* Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 5, p. 463.

1910. *Cnemidophorus immutabilis* Werner, Mitt. Nat. Hist. Mus. Hamburg, vol. 27, p. 27.

1928. *Cnemidophorus deppi* Ortenburger, Mem. Univ. Michigan Museums, vol. 1, p. 140.

Systematic notes.—The many-lined race runner was described by Wiegmann (1834 [10]) from an 8-striped Mexican specimen. From the description it is obvious that the type represents the present form, and it seems important that it was recognized that there is a very close resemblance between *deppii* and *lemniscatus*, the chief difference being the normal possession of three large parietals and three supraoculars in *deppii* as opposed to the normal possession of five large parietals and four supraoculars in *lemniscatus*. The color is in many cases practically identical.

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[10] Since the original description is not generally available, it is thought worth while to quote Wiegmann's Latin diagnosis in full: "Squamis menti parvis, gulae intermediis majoribus; sq. mesoptychii mediocribus, imbricatis, rhombeis; scuto labii superioris primo denticulato; superne cineraceus, vittis dorsi octo pallide viridibus, ad latera immaculatus."

Cnemidophorus decemlineatus was described by Hallowell in 1860 from a series of 10-lined specimens from Nicaragua. Since 10-lined specimens are common throughout the range of *deppii* and occur very frequently in Colima and Nayarit in the northern part of it, the suppression of *decemlineatus* seems entirely justified.

A specimen from Oaxaca was described as *lativittis* by Cope in 1877. The type has eight lines and this resemblance to *octolineatus* (=*perplexus*) caused Cope to cite differences from that form in his diagnosis. Since these differences were all toward *deppii* which is widespread in the coastal region of Oaxaca, *lativittis* was early reduced to its synonymy.

The specimens from Colima and Jalisco, as well as those examined by the writer from Nayarit, usually differ from specimens from Oaxaca and Vera Cruz by having ten or eleven pale lines on the back as do specimens from Nicaragua. This variation caused Cope (1877) to describe a series of such northern variants as *lineatissimus*. Since 10 or 11 lined *deppii* are sometimes found in Oaxaca and Vera Cruz and since they also occur normally in certain parts of Nicaragua at least, there is nothing geographically distinctive in *lineatissimus*. Therefore, it, too, has been relegated to the synonymy of *deppii*.

Some abnormal specimens of *deppii* from San Mateo, Costa Rica, were described by Cope in 1894 as *alfaronis*. These were typical *deppii* in coloration, having 9 dorsal lines, but differed in scutellation by the presence of 4 supraoculars instead of 3. Since this anomaly occurs now and then in *deppii* everywhere, as remarked by Gadow (1906, 309) and indicated below (see p. 60), *alfaronis* can not be retained as a distinct entity.

Diagnosis.—The many-lined race runner is distinguished by its small maximum size (usually less than 85 mm. from snout to anus) and the usual presence of 3 supraoculars, 3 parietals, granular postantebrachials and weak caudial keels. Specimens are seldom, if ever, unicolor, and may be either spotted or lined. The normal young possess from 6 to 13 well-defined, white stripes, which are usually straight, but may be more or less wavy. With development spots may appear in the lateral interspaces, but they never spread to form cross-bars as in *gularis*. The lines on the sides, especially the lower pair, may disappear with development, or the 3 dorsal stripes may united into a single broad, middorsal streak, and at times all of the stripes are very faint, almost obsolete.

Although they may usually be diagnosed at once, examples of *deppii* are sometimes so close to *guttatus* that separation is almost impossible. There are apparently no differences in scutellation. However, most individuals of *guttatus* exceed the maximum length of *deppii* indicated above, and although there are usually two distinct, lateral lines at the base of the tail in *deppii*, there is usually only one in *guttatus*. Also, the femora of *deppii* are usually covered by distinct, rounded, light spots, while those of *guttatus* are usually unicolor or obscurely marked.

Anal spurs, although often found in the adults of *lemniscatus*, are universally absent in *deppii*.

Description.—Snout moderately elongate; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars normally 3; superaocular granules usually small, forward extent variable; frontoparietals normally 2; parietals 3; anterior gulars moderate to large, graded, largest centrally; posterior gulars smaller, contrasted with anterior gulars; mesophychial scales moderate to large, largest centrally, or medio-laterally, graded and smaller laterally, in 2–5 rows; postmesoptychial granules minute, sometimes extending to edge of posterior mesoptychial fold.

Body elongate; ventral plates in 8 longitudinal and 30–38 transverse rows; dorsal granules minute to moderate; limbs well developed; brachials 3–8; antebrachials 2–4; brachials and antebrachials more or less continuous at a point of contact; postantebrachials small or slightly enlarged; femorals 4–9; tibials 2–4; femoral pores 12–23; tail elongate, tapering; subcaudals smooth; lateral and dorsal caudals weakly keeled, slightly oblique and moderate in size, keels usually irregularly arranged.

Coloration variable; lower surfaces white to blue-black, often slaty or slaty-blue, especially in the young; lower surfaces of tail usually white or yellowish, upper surface brown, blue, gray or olivaceous, usually not spotted or reticulated; tail usually with two narrow, diminishing, lateral stripes on each side of its base; femora usually strongly spotted or reticulated with white, especially in the young, but sometimes nearly unicolor; back usually lined, rarely spotted; sides spotted, lined and spotted, or only lined; if fully lined, 6 to 13 stripes present; width of stripes variable, stripes usually straight, seldom wavy, dorsal pair often converging on the median line posteriorly and anteriorly to produce an elongate, double-pointed oval, and sometimes united with the middorsal stripe to produce a broad, light streak; dorsal ground color usually blackish or gray, but sometimes brownish.

A series of 1023 specimens of *deppii* has been examined. Data on a representative series of 700 examples are as follows: Body 24–86 mm.; tail, 54–207; total length, 86–288; width of head, 4.0–12.5; length of hind leg, 20–55; supraoculars 3 in 612 specimens, 3–4 in 40 specimens and 4 in 48 specimens; supraocular granules extending forward to the anterior border of the fourth supraocular in 1 specimen, to the middle of the third supraocular in 601 specimens, to the anterior border of the third supraocular in 46 specimens, to the middle of the second supraocular in 9 specimens and to the anterior border of the second supraocular in 2 specimens.

Variation.—Gadow (1903, p. 113) called attention to the fact that not over 6 per cent of *deppii* have less than 9 longitudinal light lines on the body. The occurrence of a 6-lined specimen is very rare, but 8-lined ones are found more frequently. Gadow (1906, p. 295) wrote that "the greatest number of stripes occur in old specimens, and this fact is not due to the others having been weeded out, since many-striped young are not relatively, but positively, rare." The writer finds that the young and the adults usually show the same number of stripes and sees no reason why more should be found in adults. However, it is just possible that Gadow confused young, six-lined specimens of *gularis* with those of *deppii.*

Abnormalities in the striping frequently occur in Nayarit, Jalisco and Colima for here the usual dorsal stripes, although often distinct, frequently combine to produce a single, widened, heavy, conspicuous middorsal line. This aberration is seldom seen elsewhere. As maintained elsewhere (p. 58), regional variation in the number of stripes is common, but has little taxonomic significance because of its repetitive character.

Gadow (1906, p. 309) listed the supraoculars of 152 specimens as normally three, but said that there were 10.0 percent of exceptions. This is close to the writer's figure of 9.7 percent, which is based on 700 examples.

Range.—The many-lined race runner occurs in the lower levels along the Mexican coast southward from Nayarit and Vera Cruz, and is found in Central America as far south as Costa Rica. It probably does not extend inland above an elevation of 4,000 feet.

The report of *deppii* from Caracas, Venezuela, given by Boulenger (1885), and copied by others, was probably based on a young specimen of *lemniscatus.*

The available records are presented below in an alphabetical series by countries, and under them by the largest political subdivisions.

COSTA RICA.—Prov. of Alajuela (*San Mateo*, Cope, 1894, p. 199, A.M.N.H.). Comarca de Puntarenas (*Tirives*, U.S.N.M.).

GUATEMALA.—Dept. of Guatemala (*Guatemala*, U.S.N.M.; *Hacienda Neja*, M.C.Z.). Izabal (*Los Amates*, Atkinson, 1907, p. 155). Peten (*General Report*, U.S.N.M.). Zacapa (*Gualan*, Atkinson, 1907, p. 155, U.S.N.M., A.N.S.P.; *Zacapa*, U.S.N.M.).

HONDURAS.—Dept of Cortes (*San Pedro*, US.N.M.; *West of San Pedro*, F.M.N.H.). Tegucigalpa (*Hacienda Santa Ana*, F.M.N.H.). Valle (*Road above Pespore*, F.M.N.H.).

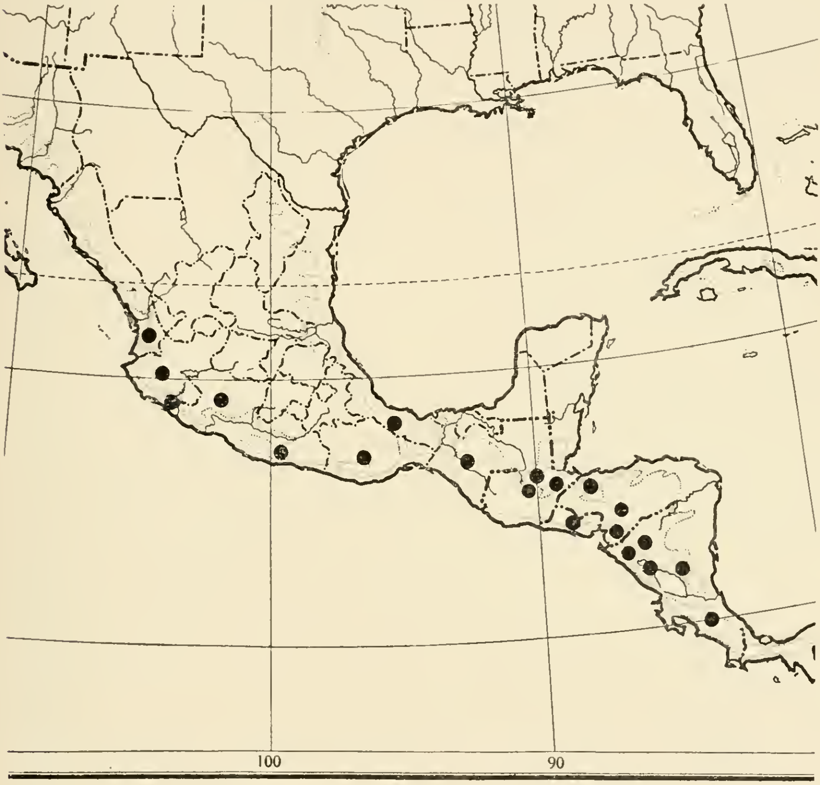

Figure 13.—Map showing locality records for Cnemidophorus deppii deppii (reports by largest political subdivisions)

MEXICO.—States of Chiapas (*Tonala*, U.S.N.M.). Colima (*Campos*, Los Angeles Mus.; *Colima*, Cope, 1877, p. 94, U.S.N.M., A.M.N.H., M.C.Z., Mich.; *East of Colima*, A.M.N.H; *South of Colima*, A.M.N.H.; *La Quinta*, A.M.N.H.; *Los Tapestes*, A.M.N.H.; *Manzanillo*, Los Angeles Mus.; *San Cayetana*, A.M.N.H.; *6 miles east of Tecoman*, A.M.N.H.). Guerrero (*Acapulco*, Los Angeles Mus.; *Ayutla*, Gadow, 1906, p. 277; *Balsas*, Gadow, 1906, p. 277, F.M.N.H.; *Cacahuamilpa*, M.V.Z.U.C.; *Chilpancingo*, Gadow, 1906, p. 277; *Cocoyul*, Gadow, 1905, p. 195; *Los Cajones*, Gadow, 1906, p. 277; *Tierra Colorado*, Gadow, 1906, p. 277; *Tlapa*, U.S.N.M.; *Totolapan*, Gadow, 1905, p. 195). Jalisco (*La Tres Marietas Islands, middle island*, C.A.S.; *Vallarta*, A.M.N.H.; *Valley near Guadalajara*, Cope, 1877, p. 94, U.S.N.M.). Michoacan (*Alvarado*, M.C.Z.; *La Salada*, U.S.N.M.; *Mescala*, Gadow, 1906, p. 277). Nayarit (*Minamon*, U.S.N.M.; *San Blas*, Van Denburgh, 1897b, p. 463, U.S.N.M., A.M.N.H.). Oaxaca (*Chivela*, A.M.N.H., M.C.Z.; *Juchitan*, Cope, 1877, p. 95, U.S.N.M.; *Miahuatlan to Ejutla*, A.M.N.H.; *Mixtequillo*, C.A.S., A.M.N.H.; Oaxaca, M.V.Z.U.C.; *Salina Cruz*, Gadow, 1906, p. 277, A.M.N.H.; *San Carlos*, Gadow, 1906, p. 277; *San Domingo*, Gadow, 1906, p. 277; *San Geronimo*, A.M.N.H., F.M.N.H.; *San Luis Allende*, Gadow, 1906, p. 277; *Santiago Astata*, A.M.N.H.; *Tapanatepec*, M.C.Z.; *Tehuantepec*, Gadow, 1906, p. 277, U.S.N.M.; *3 miles north of Tehuantepec*, A.M.N.H.; *West Tehuantepec*, Cope, 1887, p. 44; *Tequesixtlan*, Gadow, 1906, p. 277). Vera Cruz (*Agua Fria*, Gadow, 1906, p. 277; *Chichicaxtle*, U.S.N.M.; *Coatzacoalcos Bay*, U.S.N.M.; *Cuatotlapan*, Mich.; *El Potrero*, M.C.Z.; *Mandinga*, A.M.N.H.; *Otopa*, Ruthven, 1912*b*, p. 231, F.M.N.H.; *South of Panteon Viego*, A.M.N.H.; *Perez*, Ruthven, 1912*b*, p. 231, F.M.N.H..; *Sand Dunes 2 miles south of Vera Cruz*, A.M.N.H.; *San Francisco*, Ruthven, 1912*b*, p. 231; *San Juan Evangelista*, Gadow, 1906, p. 277; *Vera Cruz*, Ruthven, 1912*b*, p. 231, A.M.N.H., C.A.S., F.M.N.H.).

NICARAGUA.—Dept. of Chontales (*San Lorenzo*, F.M.N.H.). Chinandega (*Chinandega*, M.C.Z.; *Corinto*, Werner, 1910, p. 27). Granada (*Granada*, F.M.N.H.). Leon (*Momotombo*, F.M.N.H.).

SALVADOR.—(*General Report*, Gunther, 1885, p. 27).

Habitat and habits.—Very little is known concerning the habitat of this form and evidently nothing has been published about its habits. According to Gadow (1910, p. 706) *deppii* reaches a maximum altitudinal distribution of 4,000 feet in Mexico. The same author (1908, p. 139) found it on the "open savannahs of Juanita," and recalled (p. 234) having seen many examples "in the sandy bed of the Tehuantepec River of southern Mexico." Ruthven (1912*a*, p. 322), working in Vera Cruz, found this subspecies to be very rare, and wrote as follows: "The three specimens taken were found in a thicket of low bushes on the savannah near the San Juan River. In this thicket, which was about a hundred meters in diameter, there were scores of *Ameira undulata*, but these three specimens of *C. deppii* were the only ones seen. That they were really rare in this habitat and not merely overlooked was shown by the fact that the thicket was worked thoroughly, and the three specimens were taken on different days in almost exactly the same place."

Enemies.—The Mexican whip snake, *Masticophis mentovarius*, was mentioned by Gadow (1908, p. 166) as preying upon these lizards.

Affinities.—The close relationship existing between *deppii* and *lemniscatus* has been emphasized above. For reasons to be given in the general discussion at the end of this work, *deppii* is presumed to have originated from the *lemniscatus* stock somewhere in Central America, thus giving rise to the group which bears its name.

The closest modern relative of *deppii* is evidently *cozumelus* with which it is structurally identical. Both are of the same general size. *C. guttatus*, although agreeing in scutellation and not varying greatly in coloration, differs considerably by its larger size, and is considered to be a somewhat more distant relative. The relationships of *cozumelus* and *guttatus* with *deppii* are discussed in detail below under the affinities of those forms.

CNEMIDOPHORUS DEPPII COZUMELUS Gadow

BROWN-BACKED RACE-RUNNER

1906. *Cnemidophorus deppei cozumela* Gadow, Proc. Zool. Soc. London, p. 316 (type locality, "Cozumel Island, east coast of Yucatan" peninsula, Quintana Roo, Mexico; 4 co-types, B.M.N.H., 1886.4.15.17–20).

Diagnosis.—The brown-backed race-runner may be distinguished as follows: supraoculars normally 3; parietals 3; postantebrachium covered with small polygones or scutes; anal spurs absent; each side with 2–5 narrow, wavy, irregular, light lines; back unicolor, with an unusually wide, yellowish brown, longitudinal band present; ground color of sides dark reddish brown, in abrupt contrast to color of dorsal band; sides and femora never with conspicuous white or blue spots; lower surfaces white or light blue.

This subspecies is easily distinguished from other forms of *Cnemidophorus* by these characters and is approached only by a phase of *deppii* which sometimes appears in southern Mexico and adjacent areas to the south, from which it may be separated by the unusually wide dorsal band and the unusually wavy, irregular, stripes on the sides.

Description.—Snout moderately pointed; nostril anterior to nasal suture; anterior nasal separated from second upper labial; supraoculars normally 3; supraocular granules usually not extending forward past the posterior border of the second supraocular; frontoparietals normally 2; parietals normally 3; anterior gulars small to moderate laterally, graded, and with an enlarged patch medially; anterior and posterior gulars usually abruptly differentiated; posterior gulars minute; mesoptychials moderate to large, uniform, or a little smaller laterally, arranged in 2–5 enlarged transverse rows; postmesoptychials minute usually hid behind posterior gular fold.

Body moderately elongate; ventrals arranged in 8 longitudinal and 31–36 transverse rows; dorsal granules fine; limbs well developed; brachials 6–9; antebrachials 2–4; brachials continuous with antebrachials at a point of contact; postantebrachium covered with small or slightly enlarged granules: femorals 6–10; tibials 2–4; femoral pores 15–19; tail elongate tapering; caudals moderate, lateran and dorsal keels weak, and more or less irregularly arranged.

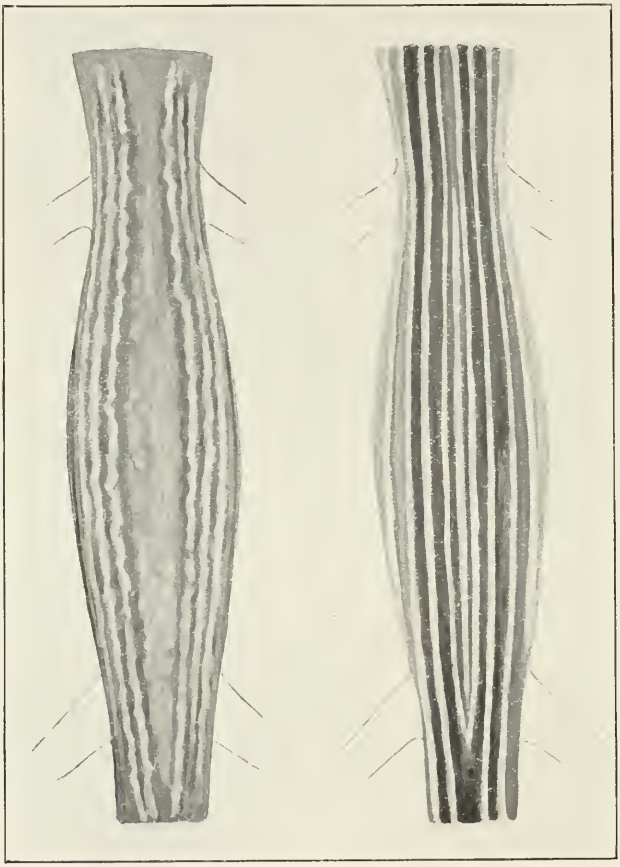

FIGURE 14.—COMPARISON OF TYPICAL COLOR PATTERN OF CNEMIDOPHORUS DEPPI COZUMELUS (LEFT) AND C, DEPPII DEPPII (RIGHT). NOTE THE WIDER MIDDORSAL BAND AND WAVY LATERAL STRIPES IN COZUMELUS

Coloration distinctive; lower surfaces white or suffused with light blue; tail uniformly brownish above, without dark reticulations; femora usually uniform brownish, spots or reticulations, if present, very obscure; femur usually not striped behind; back with and unusually broad, longitudinal band of uniform light brown; sides with 2–5 stripes each, these wavy, irregular and narrow: ground color of sides dark reddish brown, in sharp contrast to dorsal color.

The following data have been secured from three specimens from

Cozumel Island U.S.N.M. Nos. 47653–47655): Body, 57–75 mm.; tail, 137–141; total length, 194–216; width of head, 7–10; hind leg, 42–52; supraoculars 3–3 in one specimen, and 3–4 (fourth vestigial) in two specimens; supraocular granules extending forward to the middle of the third supraocular in two specimens, and to the anterior border of the third supraocular in one specimen. The frontoparietals of these three specimens are all abnormally divided and in different ways; the result is three scutes in every case.

A single specimen from Mujeres Island (U.S.N.M. No. 47652) is typical in coloration and in other features as well. It is 64 mm. long and has a regenerated tail; the head width is 7 mm.; and the hind leg is 44 mm. long. Some other features are: supraoculars, 3–3; supraocular granules extending forward to the middle of the third supraocular; and femoral pores 17–18. The frontoparietal is partly united from behind, but there is a squarish lateral scute split off from each external border posteriorly to produce a total of three scutes. This arrangement is often found in the South American teiid, *Dicrodon lentiginosus.*

In the original description Gadow, using an underline, emphasized the fact that "not only the first but also the second and even the third upper labials are denticulated." This seems to be a very unimportant distinction, however, since the same condition is found frequently in *deppii.*

In all of the specimens examined by the writer the loreal is in contact with the first supraocular, but the amount of contact varies considerably, and like the denticulation of the upper labials, it is not wholly diagnostic.

Range.—Specimens of this lizard have been examined from two islands which lie off the east coast of Quintana Roo, Peninsula of Yucatan, in southern Mexico. These are: (*Cozumel Island*, Gadow, 1906, p. 316, U.S.N.M.; and *Mujeres Island*, U.S.N.M.).

Affinities.—This form is structurally identical with *deppii*, from which it differs only in coloration. Specimens from the mainland (*deppii*) sometimes possess a more or less widened middorsal yellowish streak which resembles that of *sexlineatus.* In these the lateral stripes are usually straight, but occasionally they are more or less wavy. The transition from these to *cozumelus* is but a step. This is accomplished by the widening of the dorsal band and the modification of the lateral stripes. Thus, *cozumelus* may be considered as a direct derivative of the wide-ranging mainland *deppii*, from which it has probably been differentiated for a comparatively short time. (For a comparison of the typical color patterns of the two lizards see figure 14.)

CNEMIDOPHORUS GUTTATUS (Wiegmann)

MEXICAN RACE-RUNNER

1834. *Cnemidophorus guttatus* WIEGMANN, Herpetologia Mexicana, p. 29 (type locality, "Mexico"; type specimen, Berlin Mus. No. 867).—DUMÉRILL and BIBRON, Érp. Gén., vol. 5, 1839, p. 134.—GRAY, Cat. Liz. British Mus., 1845, p. 22.—HALLOWELL, Reptiles. Pacific R. R. Surv. (Parke Route), vol. 10, pt. 6. sect. 2, no. 2, p. 23.—GÜNTHER, Zool. Rec. for 1865, vol. 2, 1865, p. 148; Zool. Rec. for 1866, vol. 3, 1867, p. 123.—PETERS, Monatsber. Berlin Akad. Wiss., 1869, p.. 63.—GÜNTHER, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—BOCOURT, Miss. Sci. Mexique et Amer. Cent., vol. 3, 1874, p. 285, pl. 20*c*, figs. 4, 4*a–d*.—COPE, Proc. Amer. Philos. Soc., vol. 17, 1877, p. 94.—FISCHER, Oster-Progr. Akad. Gymn. Hamburg, 1883, p. 2.—GARMAN, Bull. Essex Inst., vol. 16, 1884, p. 13.—BOULENGER, Cat. Liz. British Mus., vol. 2, 1885, p. 370.—GÜNTHER, Reptilia and Batr., in "Biol. Centr.-Amer.," 1885 p. 28.—BOULENGER, Zool. Rec. for 1885, vol. 22, 1886, "Reptilia," p. 14.—FERRARI-PEREZ, Proc. U. S. Nat. Mus., vol. 9, 1886, p. 195.—COPE, Bull. 32, U. S. Nat. Mus., 1887, p. 44.—BOETTGER, Kat. der Rept.-Samml. im Mus. Senckenb. Naturforsch. Ges. Frankfurt, teil 1, 1893, p. 75.—COPE, Amer. Nat., vol. 30, 1896, pp. 1014, 1021–1022, 1025; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 568.—GADOW, Proc. Zool. Soc. London, 1905, pp. 195, 216.—ATKINSON, Ohio Nat., vol. 7, 1907, p. 155.—GADOW, Through Southern Mexico, Witherby and Co., 1908, p. 128.—RUTHVEN, Rept. Mich. Acad. Sci., vol. 14, 1912, p. 231.—SHERBORN, Index Animalium (1801–1850), pt. xi, 1926, p. 2864.

1839. *Cnemidophorus sexlineatus* (part) DUMÉRIL and BIBRON, Erp. Gen., vol. 5, p. 131.—WESTPHAL-CASTELNAU, C. R. des trav. de Cong. sci. de France, tenu à Montpellier en déc. 1868, 1870, p. 19.

1851. *Cnemidophorus sexlineatus guttatus* DUMÉRIL and DUMÉRIL, Cat. méth. Coll. Reptiles, Paris, 1851, p. 116.—LICHTENSTEIN, Nomenclator Berol., 1856, p. 13.—JAN, Indice Sist. dei. Rettili ed Anfibi Mus. Civ. di Milano, 1857, p. 40.

1862. *Ameiva guttata* COPE, Proc. Acad. Nat. Sci. Phila., p. 63.—PETERS, Monatsbr. Berl. Akad. Wiss., 1871, p. 399.

1875. *Amiva guttata* COPE, Journ. Acad. Nat. Sci. Phila., ser. 2, vol. 8, 1876, p. 118.

1877. *Cnemidophorus immutabilis* COPE, Proc. Amer. Philos. Soc., vol. 17, p. 93, (type locality, "West Tehuantepec," Oaxaca, Mexico; type specimen, U.S.N.M. No. 30141; F. Sumichrast, collector); Proc. Amer. Philos. Soc., vol. 18, 1879, p. 270.—O'SHAUGHNESSY, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—SUMICHRAST, Bull. Soc. Zool. de France, vol. 5, 1880, pp. 163, 177; La Naturaleza, ser. 1, vol. 6, 1884, p. 39.—BOULENGER, Cat. Liz. British Mus., vol. 2, 1885, p. 370.—COPE, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—BOULENGER, Proc. Zool. Soc. London, 1898, p. 916.—GADOW, Through Southern Mexico, Witherby and Co., 1908, pp. 166, 181; Zool. Jahrb., vol. 29, 1910, p. 706.—ORTENBURGER, Mem. Univ. Michigan Museums, vol. 1, 1928, p. 140.

1877. *Cnemidophorus microlepidopus* COPE, Proc. Amer. Philos. Soc., vol. 17, p. 93 (type locality, "West Tehuantepec," Oaxaca, Mexico; type specimen, U.S.N.M. No. 30187; F. Sumichrast, collector); Proc. Amer. Philos. Soc., vol. 18, 1879, p. 270.—O'SHAUGHNESSY, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—SUMICHRAST, Bull. Soc. Zoöl. France, vol. 5, 1880, pp. 163, 177; La Naturaleza, ser. 1, vol. 6, 1884, p. 39.

1877. *Cnemidophorus unicolor* COPE, Proc. Amer. Philos. Soc., vol. 17, p. 93 (type locality, "West Tehuantepec," Oaxaca, Mexico); Proc. Amer. Philos. Soc., vol. 18, 1879, p. 270.—O'SHAUGHNESSY, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—SUMICHRAST, Bull. Soc. Zool. de France, vol. 5, 1880, p. 177; La Naturaleza, ser. 1, vol. 6, 1884, p. 39.

1892. *Cnemidophorus guttatus guttatus* COPE, Trans. Amer. Philos. Soc., vol. 17, p. 32.—GADOW, Proc. Zool. Soc. London, 1906, pp. 309, 325.

1892. *Cnemidophorus guttatus immutabilis* COPE, Trans. Amer. Philos. Soc., vol. 17, p. 31.—GADOW, Proc. Zool. Soc. London, 1906, pp. 309, 326.

1892. *Cnemidophorus guttatus microlepidopus* COPE, Trans. Amer. Philos. Soc., vol. 17, p. 32.

1892. *Cnemidophorus guttatus unicolor* COPE, Trans. Amer. Philos. Soc., vol. 17, p. 32.

1903. *Cnemidophorus guttatus guttata* GADOW, Proc. Roy. Soc. London, vol. 72, p. 115.

1903. *Cnemidophorus guttatus striata* GADOW, Proc. Roy. Soc. London, vol. 72, p. 115 (type locality, "Isthmus of Tehuantepec," Oaxaca, Mexico).

1905. *Cnemidophorus striatus* GADOW, Proc. Zool. Soc. London, 1905, p. 195.

Systematic notes.—The Mexican race-runner was described by Wiegmann in 1834 from "Mexico" and, although the original account[11] is incomplete, subsequent workers have elaborated it to definitely fit the present form. It is evident that the type is of the spotted, rather than of the lined or unicolor phases of the species.

As described by Gadow (1906, p. 373), the young examples of *guttatus*, as well as some larger, forest inhabiting, individuals, are dull and frequently even unicolor. It seems that with development stripes or spots appear, usually to partly vanish again. In the case of the striped form, the lines often break into spots posteriorly before becoming obsolete, and then perhaps anteriorly as well. There is much individual variation in regard to these pattern changes. In some regions the lizards apparently retain a distinctly spotted or lined pattern throughout life.

The dull phase of *guttatus* was described as *unicolor* by Cope (1877), who diagnosed it very fully. The same author recognized his mistake later (1887, p. 44) and listed this form in the synonymy of *guttatus*.

The striped phase of *guttatus*, which apparently reaches its maximum development in certain parts of Oaxaca, was called "*immutabilis*" by Cope (1877). Thus, as remarked by Gadow (1906, p. 326), by the irony of fate *immutabilis* became the proper name of one of the most variable of lizards. The chief character of this form was "the retention of stripes throughout life." Gadow (1906, p. 287) wrote that "*C. guttatus* and *immutabilis* were considered as good species by Cope and Boulenger, but intermediate forms are

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[11] Because of its obscurity, it is thought best to present the original Latin diagnosis of *guttatus* in full, as follows: "Squamis gulae intermediis majoribus squamis mesoptychii magnis, subrhombeis, imbricatis; dorso cineraceo, guttis albidis longitudinaliter adsperso; lateribus superne nigricantibus, immaculatis, vittaque gemina marginatis."

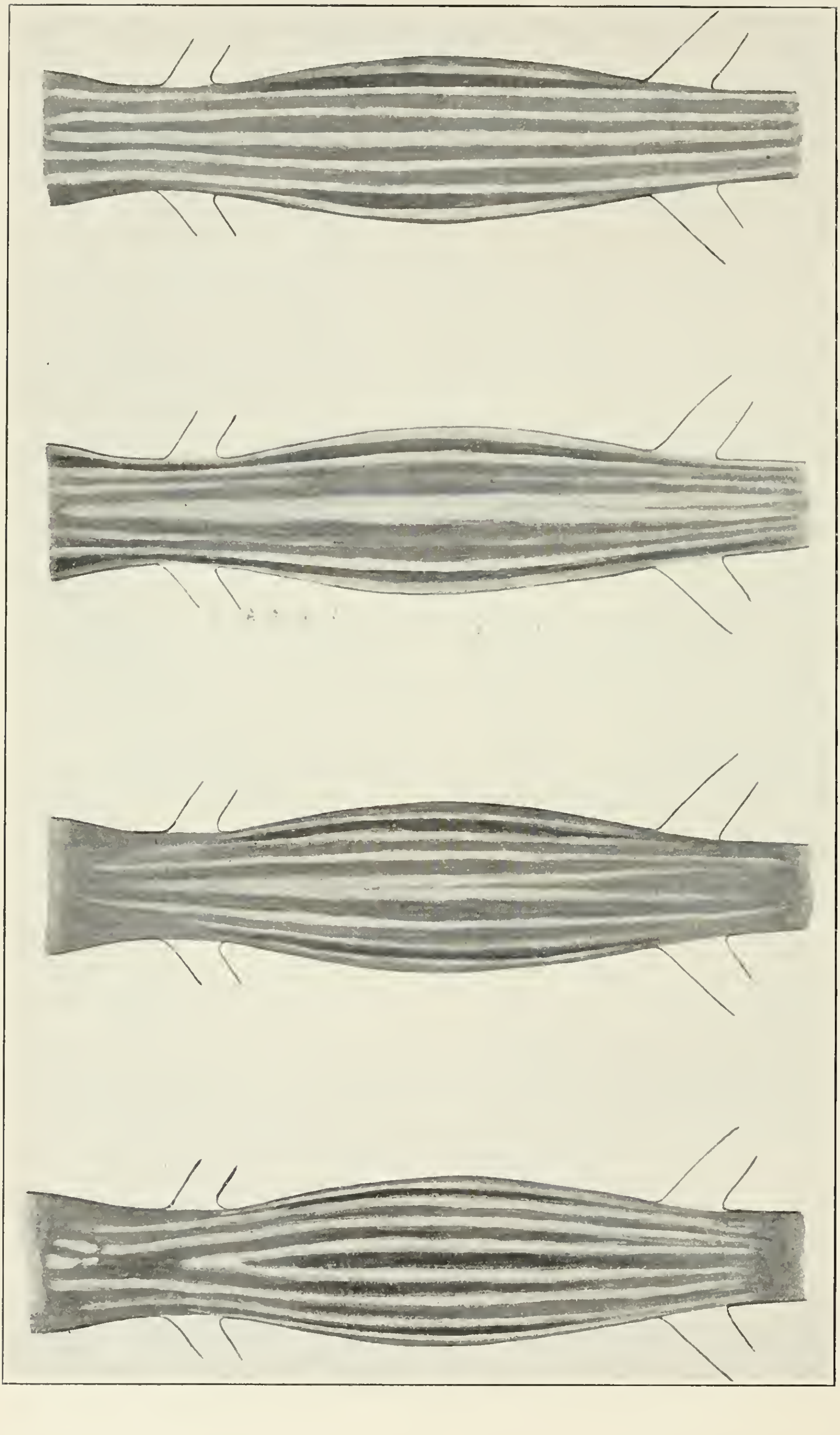

Figure 15.—Cnemidophorus guttatus. Variation in the dorsal striping of the lined phase, showing transition from eight to seven stripes

found living in districts of intermediate bionomic conditions, so that now at best they are subspecies, if not local races, or, worse still, only pattern varieties." It is significant that most of Gadow's intermediate specimens came from southeastern Guerrero, instead of from the Isthmus of Tehuantepec. These "intergrades" are not geographically intermediate between the spotted eastern *guttatus*, which Gadow confined to Vera Cruz, and the striped *immutabilis* from Oaxaca, but are found isolated on the Pacific slope of Oaxaca where only typical *immutabilis* is theoretically expected. After the examination of a large series of these lizards the writer feels that the two entities under discussion should no longer stand apart. Although certain populations do appear to be moderately well differentiated, pattern intermediates are found in many places and in addition the appearance of unicolored young in both phases makes it increasingly difficult to separate one from the other. Moreover, it appears that the lined phase sometimes changes into the spotted one.

A specimen typical of *immutabilis* was described as *microlepidopus* by Cope (1877) with the statement that "This form differs from the typical *guttatus* in color only and may be the young. The median dorsal region is, however, unspotted." An examination of the type shows it to be an 8-lined specimen, the dorsal stripes unbroken. Just why *immutabilis* and *microlepidopus* should have been designated as *different* species in the same contribution is not apparent.

Evidently through an oversight, Gadow (1903) described *striatus* from the type locality of *immutabilis*, citing differences from the spotted *guttatus*. Soon after this (1906, p. 374), he listed the new form in the synonymy of *immutabilis*.

Diagnosis.—The Mexican race runner is distinguished by its large maximum size and the usual presence of three supraoculars, three parietals, granular postantebrachials and weak caudal keels. Specimens may be unicolor, spotted or striped. If spotted, the spots are usually confined to the dorsal region only. The unicolor specimens are mostly young and are generally gray or blackish instead of brownish as in *gularis*. The maximum number of stripes is eight.

Examples of *deppii* are sometimes so close to *guttatus* that separation is almost impossible, although usually specimens may be diagnosed at once. There are apparently no differences in scutellation. The largest *deppii* seldom exceed a length of 80–85 mm. from snout to anus, but the larger *guttatus* specimens always exceed this length and the smaller ones are generally unicolor. Although there are usually two distinct, lateral, light lines on each side of the base of the tail in *deppii*, there is usually only one in *guttatus*, and whereas the femora of *deppii* are often covered by distinct, rounded, light spots, those of *guttatus* are usually obscurely spotted or reticulated with white. The unicolor phase probably does not occur in *deppii.*

Anal spurs, although often found in *lemniscatus*, are universally absent in *guttatus.*

Description.—Snout moderately elongate; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars normally 3; supraocular granules usually small, forward extent variable; frontoparietals normally 2; parietals 3; anterior gulars moderate to large, graded, largest centrally; posterior gulars smaller, contrasted with anterior gulars; mesoptychial scales moderate to large, largest centrally or medio-laterally, graded and smaller laterally, in 2–5 rows; postmesoptychial granules minute, sometimes extending to edge of posterior gular fold.

Body elongate; ventral plates in 8 longitudinal and 30–40 transverse rows; dorsal granules minute to moderate; limbs well developed, strong; brachials 4–7; antebrachials 2–3; brachials and antebrachials continuous or subcontinuous at a point of contact; postantebrachium covered with small or slightly enlarged granules; femorales 5–10; tibials 2–4; femoral pores 17–26; tail elongate, tapering; subcaudals smooth; lateral and dorsal caudals smooth or weakly keeled, slightly oblique, and moderate in size, keels irregularly arranged.

Coloration variable; lower surfaces white to dark blue, often slaty or slaty blue, especially in the young; lower surface of tail usually white or yellowish, upper surface brown, blue, or olivaceous usually not spotted or reticulated; tail with a narrow, diminishing, lateral stripe on each side anteriorly, seldom with two stripes on each side; femora weakly spotted or reticulated with white; back unicolor, spotted or lined; if unicolor, traces of stripes may be present laterally; if spotted, lines may or may not be present laterally; if lined, spots may or may not be present dorsally or posteriorly, stripes varying from six to eight in normal individuals, width of stripes variable; dorsal ground color usually blackish or gray, seldom brownish.

A series of 448 specimens of the Mexican race runner has been examined, and data from 300 of these may be presented as follows: Body, 35–138 mm.; tail, 130–295; total length, 184–425; length of tail as percentage of total length, 60–73.2; width of head, 6–22; width of head as percentage of body length, 12.0–15.7; hind leg, 26–83; length of hind leg as percentage of body length, 58.0–77.4; frontoparietals partly united into a single scute in 3 specimens, distinct and in two scutes in 292 specimens, and abnormally split into three scutes in 5 specimens; supraoculars three in 279 specimens, 3–4 in 10 specimens, and 4 in 11 specimens; supraocular granules extending forward to the middle of the third supraocular in 113 specimens, to the anterior border of the third supraocular in 78 specimens, to the middle of the second supraocular in 74 specimens, and to the anterior border of the second supraocular in 34 specimens.

Variation.—Gadow (1906, p. 320) reported upon 61 specimens of the present species. He found that the "supraoculars were normally three, but that there are 12–14 percent exceptions." Calculations from the writer's data on the 300 specimens discussed above, show less than 6 per cent exceptions.

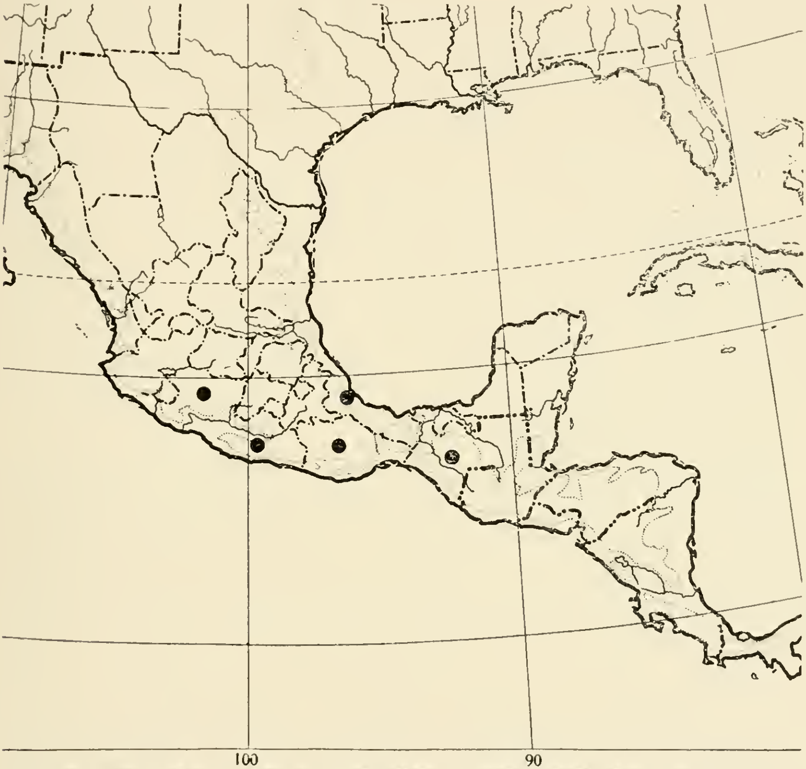

FIGURE 16.—MAP SHOWING LOCALITY RECORDS (STATE REPORTS) FOR CNEMIDOPHORUS GUTTATUS

Gadow (p. 283) examined the dorsal granules of a series of *guttatus* from Aqua Fria and found that they vary in number from 100 to 180 across the back.

Peters (1871, p. 399) wrote that the type specimen has the frontal shield transversely divided behind. This condition is normal in *Ameiva bifrontata bifrontata* and its allies from northern South America, but is wholly abnormal in *guttatus*.

Aside from the tendency for the adults of the Mexican race-runner to possess a spotted pattern in Eastern Mexico, and to possess a striped pattern in Western Mexico, as discussed in the systematic notes, little geographical variation is evident.

Range.—The Mexican race-runner is apparently confined to the mainland of Mexico and occurs along the Gulf coast of Vera Cruz, throughout the region of the Isthmus of Tehuantepec, and along the Pacific coast from Chiapas to Michoacan. Its detailed distribution follows alphabetically by states:

CHIAPAS.—(*Tonala*, U.S.N.M.: *Mountains near Tonala*, U.S.N.M.).

GUERRERO.—(*Acapulco*, U.S.N.M., A.M.N.H.; *Ayutla*, Gadow, 1906, p. 309; *Chilpancingo*, Gadow, 1906, p. 309; *Cocoyul*, Gadow, 1906, p. 309; *Los Cajones*, Gadow. 1906, p. 309; *Tierra Colorado*, Gadow, 1906, p. 309; *Totolapan*, Gadow, 1905*b*, p. 195).

MICHOACAN.—(*Alvarado*, M.C.Z., Mich.).

OXACA.—(*Chacalpa*, A.M.N.H.; *Chivela*, A.M.N.H., M.C.Z.; *Mixtequillo*, A.M.N.H., C.A.S.; *Mountain*, *Giengda*, A.M.N.H.; *Oaxaca*, M.V.Z.U.C; *Sadani*, AM.N.H.; *Salina Cruz*, Gadow, 1906, p. 309; *Salina Cruz Cemetary*, A.M.N.H.; *West Salina Cruz*, A.M.N.H.; *San Geronimo*, A.M.N.H., F.M.N.H.; *San Luis Allende*, Gadow, 1906, p. 309; *San Mateo del Mar*, Gadow, 1906, p. 309; *Santiago Astata*, A.M.N.H.; *Santo Domingo*, Boettger, 1893, p. 75; *Tapanatepec*, M.C.Z.; *Tehuantepec*, U.S.N.M.; *3 miles north of Tehuantepec*, A.M.N.H.; *West Tehuantepec*, Cope, 1887, p. 93; *Tequesixtlan*, Gadow, 1906, p. 309).

VERA CRUZ.—(*Coatzacoalcos Bay*, U.S.N.M.; *El Potrero*, M.C.Z.; *Jalapa*, Cope, 1887, p. 44, M.C.Z.; *La Antigua*, Ruthven, 1912*b*, p. 231, F.M.N.H.; *Orizaba*, Cope, 1887, p. 44; *Otopa*, Ruthven, 1912*b*, 231, F.M.N.H.; *Perez*, Ruthven 1912*b*, p. 231, F.M.N.H.; *Rio Blanco*, Ruthven, 1912*b*, p. 231, F.M.N.H.; *San Francisco*, F.M.N.H.; *Vera Cruz*, Cope, 1887, p. 44, A.M.N.H., C.A.S., A.N.S.P.).

Habitat and habits.—Very little is known of the habitat of this form and apparently nothing has been published concerning its habits. According to Gadow (1906, p. 277), "*Guttatus* does not leave the Tierra Galiente above the 3,000 feet level. Greater heights are an absolute barrier." He (p. 325) considered the spotted phase as characteristic of the "open forests with dense undergrowth, or similar pitches of woodland, in the State of Vera Cruz and its confines with those of Oaxaca." That is, in the Atlantic Tierra Caliente, "with its decidedly denser vegetation, with fewer deciduous trees and much greater rainfall," the "typical" spotted phase occurs. It was stated (p. 326) that the striped lizards prevail in the small open localities, and that "much tangled underbrush, broken terrain, well-wooded ravines, or meadows with tall grass and herbs, or rivers fringed with masses of shrubs," were the features of the spots that yielded the most intermediate specimens.

Enemies.—The Mexican whip snake, *Masticophis mentovarius*, was mentioned by Gadow (1908, p. 166) as preying upon these lizards.

Affinities.—Because of its geographical and structural identity with *deppii* and its marked differences from *gularis*, its only other possible ancestor, *guttatus* is here considered as a direct derivative of *deppii*, or, perhaps more properly, of ancestral *deppii-like* stock. The occurrence of both *guttatus* and *deppii* in the same region is contrary to the usually applicable rule that directly related forms are not found in the same locality. This occurrence would seem, at first sight, to indicate speciation by mutation alone as suggested by Blanchard (1921, p. 253) for *Lampropeltis californiae californiae* which is found in southern California in coextensive distribution with *Lampropeltis getulus boylii*, from which it is apparently derived. For these Californian snakes, mutation alone, without isolation, seems to be the only possible means of speciation, but for the forms found in the region of Central America and southern Mexico, such as *deppii* and *guttatus* in this case, it is not necessary to resort wholly to this explanation. The theory of speciation by isolation (during which mutation has an oportunity to become of constant nature and hence of diagnostic value) may be used here. (See fig. 17.)

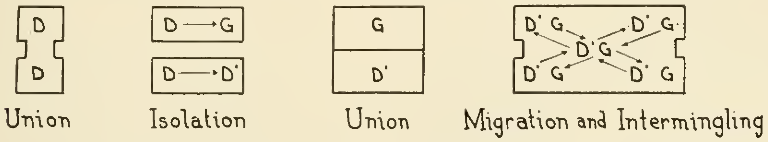

Figure 17.—A theoretical diagram of the manner in which two closely related species, at present in co-extensive distribution, may have evolved from a common stock through isolation. *D* and *D'*=deppii; *G*=guttatus

It has generally been conceded by geologists (see Schuchert, 1929, p. 141) that the Tehuantepec region was lowered to below sea level in the post-Miocene or early Pliocene and that the resulting water barrier kept Central American forms isolated from those in southern Mexico for a significant length of time.

For reasons to be presented in the general discussion at the end of this work it is presumed that the ancestral *deppii* stock became modified from the ancient *lemniscatus* stock during the late Miocene. Once differentiated, this generalized type spread northward and probably entered southern Mexico before the formation of the Tehuantepec portal. After the subsequent isolation and upon the re-formation of the Tehuantepec land bridge, later in the Pliocene, there is the possibility of a secondary union of the northern and southern faunal elements.

Although *guttatus* is not found south of Mexico, *deppii* ranges south to Costa Rica, so during the submergence of the Tehuantepec region *deppii* is presumed to have remained unchanged or to have developed in Central America, whereas *guttatus* changed and evolved in southern Mexico. A secondary union of the land masses involved would have made it possible for the more plastic *deppii* to migrate northward into Mexico and not only to extend its range throughout the favorable area there occupied by *guttatus* but also to extend it northward along the Pacific slope, past the range of that form, into Colima and Nayarit as well. Such an explanation may also account for the great overlapping in the ranges of the closely related *Ameiva undulata* and *Ameiva festiva* which are also found in Central America and Mexico. The foregoing diagram (fig. 17) is intended to illustrate the manner in which *guttatus* and *deppii* as closely related forms have assumed their present coextensive distribution.

SUMMARY OF THE DEPPII GROUP

The *deppii* group is confined to Mexico and Central America. Its representatives are alike in scutellation and resemble each other in color pattern, but the adult size is variable. There are three forms, *deppii*, *cozumelus*, and *guttatus*. In searching for the prototype among these one has to consider only *deppii* and *guttatus* since *cozumelus* is an insular form which has obviously been recently isolated and derived from *deppii*. The remaining two forms are likewise closely related, but *deppii* is thought to be the older unit because of its much closer geographical and colorational approach to *lemniscatus* with which it agrees in size and from the stock of which the *deppii* group is obviously derived.

Since a consideration of the genetic origin of the group as a whole, and hence of the prototypic *deppii*, is given in the general discussion at the end of this work (pp. 251–260), the present consideration will be limited to the origin and relationships of the two derivatives, *cozumelus* and *guttatus*.

Cozumelus is known only from the islands of Cozumel and Mujures off the coast of Quintana Roo in southern Mexico. These islands are very near to the mainland and the lizards are small like *deppii*, differing from it only in a slight but apparently constant modification of the color pattern. Because of this, and since *guttatus* and *gularis*, the other possible ancestors, differ greatly in size and scutellation, respectively, *cozumelus* is thought to be a direct descendant from a common stock with *deppii*.

The remaining form, *guttatus*, occurs only on the Mexican mainland. Because of its striking similarity to *deppii* and its obvious differences from *gularis*, it is considered to be a derivitive from the ancestral stock of the modern *deppii*. Its manner of origin is a matter of some doubt as indicated in the discussion of its affinities. Because of its coextensive distribution with the parent form, speciation by mutation, in place, is at first sight indicated. It is thought, however, that the natural geological changes that have occurred in the region of Central America and Mexico, in this case at the isthmus of Tehuantepec, may have permitted speciation during a temporary period of isolation. Even this theory is thought to be in accordance with the principle of speciation by mutation, which in itself represents the sort of variation that is thought to give rise to new forms. For a discussion and diagram of the possibilities of this theory as applied to *deppii* and *guttatus* see pages 73 and 74.

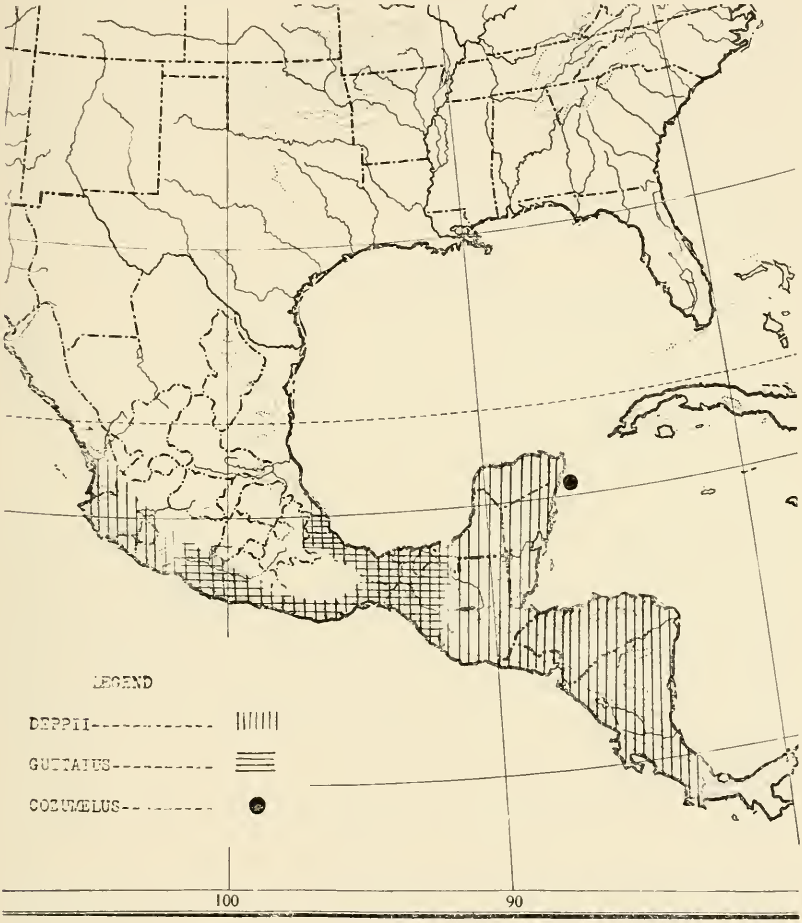

FIGURE 18.—MAP SHOWING DISTRIBUTION OF FORMS OF DEPPII GROUP

The apparent relationships within the *deppii* group are expressed by the following diagram (fig. 19).

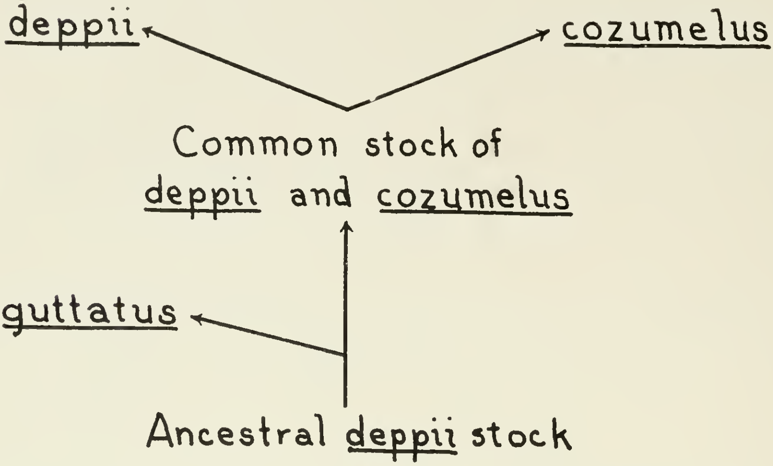

Figure 19.—Diagram of supposed relationships within the deppii group

THE SEXLINEATUS GROUP

CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS (Linnaeus)

SIX-LINED RACE-RUNNER

1766. *Lacerta sexlineata* Linnaeus, Syst. Nat., ed. 12, vol. 3, p. 364, (type locality, "Carolina," eastern United States).—Gmelin, Syst. Nat., ed. 13, vol. 3, 1788, p. 105.—Daudin, Hist. Nat. Reptiles, vol. 3, 1802, p. 183.—Shaw, Gen. Zool., Amph., vol. 3, 1802, p. 240.—Turton, English Ed. of Linneaus' "Syst. Nat.," vol. 1, 1806, p. 667.—Fitzinger, Neue Classif. Reptilien, 1826, p. 51.—Harlan, Journ. Acad. Nat. Sci. Phila., vol. 6, 1827, pp. 18, 370. Schinz, Naturg. u. Abbild. Reptilien, 1833, p. 102.—Harlan, Med. and Phys. Researches, 1835, pp. 144, 163.—Sherborn, Index Animalium (1758–1800), 1902, p. 897.

1774. *Lacerta 6-lineata* Müller, German trans. of Linneaus' "Syst. Nat.," ed. 12, vol. 3, p. 94, (all).—Garman, Bull. Essex Inst., vol. 16, 1884, p. 12 (part).

1789. *Lacerta sex-lineata* Bonnaterre, Erpetol., Tabl. Ency. Nature, p. 48.—Sonnini and Latreille, Hist. Nat. Reptiles, vol. 1, 1802, p. 245.—Sclater, Reprint edition of *Forrester's* "Cat. of the Animals of N. Amer.," 1882, p. 18.

1820. *Teius lemniscatus* Merrem, Syst. Amph., p. 60, (part).

1820. *Lacerta fallax* Merrem, Syst. Amph., p. 63, (type locality, "Carolina," eastern United States).

1831. *Ameiva sex-lineata* Cuvier, Animal Kingdom, English transl. by H. M'Murtrie, Class III, Reptilia, vol. 2, p. 22.—Holbrook, N. Amer. Herpetology, ed. 1, vol. 1, 1836, p. 63, pl. 6.—Bruhn, Zool. Garten. vol. 15, 1874, p. 396.—Nehrling, Zool. Garten, vol. 25, 1884, p. 259.

1831. *Seps sexlineata* Cuvier, Animal Kingdom, English translation by H. M'Murtrie, Class III, Reptilia, vol. 2, p. 23.

1831. *Ameiva sexlineata* Cuvier, Animal Kingdom, English translation by H. M'Murtrie. Class III, Reptilia. vol. 2, p. 23.—De Kay, Zool. of N. Y., vol. 1, pt. 3, p. 30.—Holbrook, N. Amer. Herpetology, ed. 2, vol. 1, 1842, p. 109, pl. 15; Reptiles, in White's Statistics of Georgia, "Flora and Fauna," 1849, p. 13.—Hallowell, Reptiles, in Sitgreaves' "Rept. of an Expedition down the Zuni and Colo. Rivers," 1853, p. 107.

1834. *Lacertam sexlineatam* Wiegmann, Herpetologia Mexicana, p. 27 (footnote).

1839. *Cnemidophorus sexlineatus* Duméril and Bibron, Erp. Gén., vol. 5, p. 131.—Fitzinger, Syst. Reptilium, 1843, p. 20.—Gray, Cat. Liz. British Mus., 1845. p. 21.—Baird and Girard, Proc. Acad. Nat. Sci. Phila., 1852, p. 128.—Hallowell, Reptiles, in Sitgreaves' "Rept. of an Expedition down the Zuni and Colo. Rivers," 1835, p. 145.—Jan, Indice, Sist. dei Rettili ed Anfibi Mus. Civ. di Milano, 1857, p. 40.—Hallowell, Reptiles, Pacific R. R. Surv. (Parke Route), vol. 10, pt. 6, sect. 2, no. 2. 1859, p. 23.—Reinhardt and Lütken, Vidensk. Meddel. nat. Foren., 1861, p. 233; Vidensk. Meddel. nat. Foren., 1862, p. 168.—Günther, Zool. Rec. for 1865, vol. 2, p. 148; Zool. Rec. for 1866, vol. 3, 1867, p. 123.—Philippi, Archiv Naturgesch., vol. 35, 1869, p. 42.—Peters, Monatsber. Berlin Akad. Wiss., 1869, pp. 62-63.—Coues, Proc. Acad. Nat. Sci. Phila., 1871, p. 47.—Vilanova y Piera, La Creacion (Hist. Nat.), vol. 5, 1874, p. 39.—Warren, Prelim. Rept. Expl. in Nebr. and Dakota in the years 1855–59, Reprint, Eng. Dept., U. S. Army, 1875.—Jordan, Man. Vert. Northern U. S., ed. 1, 1876, p. 170.—Cope, Proc. Amer. Philos. Soc. vol. 17, 1877, p. 65; Proc. Amer. Philos. Soc., vol. 17, 1877, p. 95.—Jordan, Man. Vert. Northern U. S., ed. 2, 1878, p. 170.—Cope, Bull. U. S. Nat. Mus., vol. 17, 1880, p. 18.—Cragin, Trans. Kan. Acad. Sci., vol. 7, 1881, p. 117.—Smith, Rept. Geol. Surv. Ohio, vol. 4, 1882, p. 653.—Davis and Rice, Bull. Chicago Acad. Sci., vol. 1, 1883, p. 31.—Garman Mem. Mus. Comp. Zoöl., vol. 8, 1883, p. xiv.—Fischer, Oster-Progr. Akad. Gymn. Hamburg, 1883, p. 2.—Hurter, Cat. Reptiles and Batr. Coll. in Mo., 1883, p. 6 (printed privately).—True, Vert. Animals of S. C., vol. 10, 1883, p. 237.—Cragin, Bull. Washburn Lab. Nat. Hist., vol. 1, 1884, p. 8.—Jordan, Man. Vert. Northern U. S., ed. 4, 1884, p. 170.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 364.—Hughes, Bull. Brookville Soc. Nat. Hist., vol. 1, 1885, p. 41.—Hay, Ann. Rept. Indiana St. Bd. Agri. for 1886, vol. 28, 1887, p. 214.—Boulenger, Zool. Rec. for 1886, vol. 23, "Reptilia," 1887, p. 13; Cat. Liz. British Mus., vol. 3, 1887, p. 505; Ann. and Mag. Nat. Hist., ser. 6, vol. 1, 1888, p. 109.—Kingsley, Riverside Nat. Hist., vol. 3, 1888, p. 432.—Stejneger, Proc. U. S. Nat. Mus., vol. 12, 1890, p. 644.—Werner, Zool. Jahrb. (abt. Syst, Geog. u. Biol.), vol. 6, 1892, p. 200.—Cope. Trans. Amer. Philos. Soc., vol. 17, 1892, p. 42; Proc. Amer. Philos. Soc., vol. 30, 1892, p. 209.—Garman, Bull. Ill. St. Lab. Nat. Hist., vol. 3. 1892, p. 255.—Boettger, Kat. der Reptilien Samml. im Mus. Senckenb. Naturf. Ges. in Frankfurt, teil 1, 1893, p. 74.—Werner, Zool. Jahrb. (abt. Syst., Geog. u. Biol.), vol. 7, 1894, p. 383.—Loennberg, Proc. U. S. Nat. Mus., vol. 17, 1894, p. 321.—Rhoads, Proc Acad. Nat. Sci. Phila., 1895, p. 386.—Cope, Amer. Nat., vol. 30, 1896, pp. 1008, 1011.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 6, 1896, p. 343; Proc. Amer. Philos. Soc., 1897, p. 463.—Mocquard, Nouv. Arch. Mus. Nat. Paris, ser. 4, vol. 1, 1899, p. 315.—Jordan, Man. Vert. Northern U. S., ed. 8, 1899, p. 201.—Smith, Proc. Linn. Soc. New York, no. 11, p. 9.—Beyer, Proc. La. Soc. Nat. Hist. for 1897-1899, 1900, p. 43.—Gadow, Cambridge Nat. Hist., vol. 8, 1901, p. 549.—Lampe, Jahrb. Nassauisch. Ver. Naturkunde, vol. 54, 1901, p. 35.—Strecker, Trans. Texas Acad. Sci., vol. 4, 1902, p. 97.—Loennberg, Bihang

K. Svenska Vet.-Akad. Handl., vol. 28, 1902, p. 29.—Hay, Proc. Biol. Soc. Wash, vol. 15, 1902, p. 134.—Gadow, Proc. Roy. Soc. London, vol. 72, 1903, pp. 112, 122.—Cohn, Zool. Anz., vol. 27, 1903, p. 187.—Stone and Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 33.—Brimley, Amer. Nat., vol. 37, 1903, pp. 264–265.—Pritchett, Biol. Bull., vol. 5, 1903, pp. 271, 284.—Morse, Proc. Ohio St. Acad. Sci., vol. 4, 1904, p. 124.—Henshaw, Occas. Pap. Boston Soc. Nat. Hist., vol. 7, 1904, p. 5.—Jordan, Man. Vert. Animals Northern U. S., ed. 9, 1904, p. 201.—Boulenger, Zool. Rec. for 1904, vol. 41, "Reptilia," 1905, p. 24.—Bailey, N. Amer. Fauna, vol. 25, 1905, p. 44.—Hartman, Trans. Kan. Acad. Sci., vol. 20, 1906, p. 226.—Kingsley, Text Vert. Zool., 1906, p. 321.—Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 111.—McAtee, Proc. Biol. Soc. Wash., vol. 20, 1907, p. 11.—Ditmars, Reptile Book, 1907, p. 188.—Brimley, Journ. Elisha Mitchell Sci. Soc., vol. 23, 1907, p. 142.—Brown, Proc. Acad. Nat. Sci. Phila., 1908, p. 118.—Surface, Zool. Bull. Div. Zool. Penn. Dept. Agri., vol. 5, 1908, p. 253.—Strecker, Proc. Biol. Soc. Wash., vol. 21, 1908, p. 73.—Hurter and Strecker, Trans. Acad. Sci. St. Louis, vol. 18, 1909, p. 23.—Hurter, Trans. Acad. Sci. St. Louis, vol. 20, 1911, pp. 139–140.—Werner, Revision of "Brehm's Tierleben," vol. 2, 1913, p. 148.—Barbour, Mem. Mus. Comp. Zoöl., vol. 44, 1914, p. 218.—Barbour and Noble, Bull. Mus. Comp. Zoöl., vol. 59, 1915, p. 420.—Anonymous, Sci. Amer., vol. 112, 1915, p. 479.—Strecker, Baylor Univ. Bull., vol. 18, 1915, p. 24.—Wright and Funkhouser, Proc. Acad. Nat. Sci. Phila., 1915, p. 129.—Brimley, Journ. Elisha Mitchell Sci. Soc., vol. 30, no. 4, p. 200.—Dunn, Copeia, no. 18, 1915, p. 6; Copeia, no. 53, 1918, p. 23.—Deckert, Copeia, no. 54, 1918, p. 31.—Holt, Copeia, no. 72, 1919, p. 66.—Dunn Proc. Biol. Soc. Wash., vol. 33, 1920, p. 136.—Conger, Key to Mich. Vert., Publ. by Mich. Agri. Coll., 1920, p. 41.—Babcock, Copeia, no. 85, 1920, p. 74.—Potter, Copeia, no. 86, 1920, p. 83.—Blanchard, Occas. Pap. Mus. Zool. Univ. Mich., no. 117, 1922, pp. 6–7.—Löding, Pap. Alabama Mus. Nat. Hist., vol. 5, 1922, p. 24.—Strecker, Bull. Sci. Soc. San Antonio, vol. 4, 1922, p. 31.—Camp, Bull. Amer. Mus. Nat. Hist., vol. 48, 1923, p. 410.—Sherborn, Index Animalium (1801–1850), pt. 3, 1923, p. 506.—Over, Bull. S. D. Geol. and Nat. Hist. Surv., vol. 12, 1923, pp 19–20.—Hallinan, Copeia, no. 115, 1923, p. 19.—Viosca, Copeia, no. 115, 1923, p. 43.—Weed, Copeia, no. 116, 1923, p. 48.—Holt, Copeia, no. 136, 1924, p. 100.—Strecker, Baylor Univ. Bull., no. 27, 1924, p. 37.—Funkhouser, Wild Life in Kentucky, 1925, p. 77.—Force, Copeia, no. 141, 1925, p. 25.—Strecker and Frierson, Contr. Baylor Univ. Mus., no. 5, 1926, p. 7.—Strecker, Contr. Baylor Univ. Mus., no. 3, 1926, p. 2; Contr. Baylor Univ. Mus., no. 6, 1926, p. 5; Idem, no. 7, 1926, p. 5.—Wright, Ecology, vol. 7, 1926, pp. 83–84.—Viosca, Ecology, vol. 7, 1926, p. 310.—Brimley, Journ. Elisha Mitchell Sci. Soc., vol. 42, 1926, p. 83.—Watson, Naturalist's Guide to the Americas, 1926, p. 434.—Harper, Johnson and Howell, Naturalist's Guide to the Americas, 1926, p. 443.—Frison and Miller, Naturalist's Guide to the Americas, 1926, p. 471.—Wolcott, Naturalist's Guide to the Americas, 1926, p. 522.—Myers, Proc. Ind. Acad. Sci. for 1925, vol. 34, 1926, p. 286.—Ortenburgher, Proc. Okla. Acad. Sci., vol. 6, pt. 1, 1926, pp. 94–95; Copeia, no. 156, 1926, p. 145; Idem, no. 163, 1927, p. 47.—Strecker, Contr. Baylor Univ. Mus., no. 12, 1927, p. 14.—Corrington, Copeia, no. 165, 1927, p. 100.—Pickens, Copeia, no. 165, 1927, p. 110.—Myers, Proc. Indiana Acad. Sci., vol. 36, 1927, p. 339.—East, Journ. Wash. Acad. Sci., vol. 17, 1927, p. 99.—Noble, Guide Leaflet Series, Amer. Mus. Nat. Hist., no. 69, 1927, p. 5.—Burt, Occas. Pap. Mus. Zool. Univ. Mich., no. 189, 1927, p. 4; Journ. Kan. Ent. Soc., vol. 1, 1928, p. 58; Trans. Acad. Sci. St. Louis, vol. 26, 1928, p. 38; Key to Lizards of Kansas, printed privately, 1928, p. 1.—Gloyd, Trans. Kan. Acad. Sci., vol. 31. 1928, p. 119.—Jones, Journ. Tenn. Acad. Sci., vol. 3, 1928, p. 12.—Strecker, Contr. Baylor Univ. Mus., no. 16, 1928, p. 12.—Ortenburger, Mem. Univ. Mich. Museums, vol. 1, 1928, p. 199.—Roddy, Reptiles of Penn., printed privately, 1928, p. 51.—Springer, Copeia, no. 169, 1928, p. 103.—Force, Proc. Okla. Acad. Sci., vol. 8, 1928, p. 78.—Pope and Dickinson, Bull. Public Mus. Milwaukee, no. 8, 1928, p. 43.—Strecker and Williams, Contr. Baylor Univ. Mus., no. 17, 1928, p. 15.—Ortenburger, Copeia, no. 170, 1929, pp. 10, 27.—Jordan, Man. Vert. Animals, ed. 13, 1929, p. 231.—Burt, Occas. Pap. Mus. Zool. Univ. Mich., no. 201, 1929, p. 8.—Strecker, Cont. Baylor Univ. Mus., no. 19, 1929, pp. 5–6, 13.—Corrington, Copeia, no. 172, 1929, p. 68.—Netting, Ann. Carnegie Mus., vol. 19, no. 3, 1930, p. 172.—Force, Copeia, no. 2, 1930, p. 28.—Noble and Teale, Copeia, no. 2, 1930, pp. 54–55.—Ortenburger, Copeia, no. 173, 1930, p. 94.

1851. *Cnemidophorus sexlineatus* (part) Duméril and Duméril, Cat. meth. Coll. Reptiles, Paris, p. 116.—Westphal-Castelnau, C. R. trav. Cong. sci. de France, tenu a Montpellier en dec. 1868, 1870, p. 19.—Bocourt, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, p. 273, pl. 20*c*, fig. 11, 11*a*, pl. 20*d*, figs. 2, 2*a–b*.—Cope, Bull. U. S. Nat. Mus., no. 1, 1875, p. 45.—Yarrow, Bull. 24, U. S. Nat. Mus., 1882, pp. 8, 43.—Günther, Reptilia and Batr., in "Biol. Centr.-Amer.," 1885, p. 25.—Palacky, Zool. Jahrb., abt. syst. geog. u. biol., vol. 12, 1899, pp. 253, 283.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 593.—Gadow, Proc. Zool. Soc. London, 1905, p. 216; Proc. Zool. Soc. London, 1906, p. 302.—Ellis and Henderson, Univ. Colo. Studies, vol. 10, 1913, p. 78.—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 67; Check List N. A. Amph. and Rept., ed. 2, 1923, p. 73.—Pratt, Man. Vert. Animals U. S., 1923, p. 204.—Cockerell, Zool. of Colo., Univ. Colo. Semicentennial Ser., vol. 3, 1927, p. 106.

1859. *Cnemidophorus sex-lineatus* Baird, Reptiles, Pacific R. R. Surv. (Whipple and Ives Route), vol. 10, pt. 6, no. 4, p. 38.—Hay, Ann. Rept. Indiana Dept. Geol. and Nat. Resources, vol. 17, 1893, p. 545.—Hurter, Trans. Acad. Sci. St. Louis, vol. 6, 1893, p. 259.

1874. *Cnemidophorus sexlineatus gularis* (part) Bocourt, Miss. sci. Mexique et Amer. cent., vol. 3, 1874, p. 278.

1884. *Cnemidophorus tessellatus* Cragin[12] Bull. Washburn Lab. Nat. Hist., vol. 1, 1885, p. 102.

1885. *Cnemidophorus sexlineatus* Holder, Wood's "Animate Creation," revised and adapted to Amer. zool., New York, vol. 3, p. 45.

1893. *Cnemidophorus sexlineilus* Cope, Proc. Acad. Nat. Sci. Phila., p. 387.

1899. *Cnemidophorus sexlinsatus* McLain, Notes on a coll. of reptiles made by C. J. Pierson at Fort Smith, Ark. (Contr. N. Amer. Herpetology), p. 2.

1900. *Cnemidophorus sexlineatus sexlineatus* Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, pp. 598, 603–605 (part).

1902. *Cnemydophorus sexlineatus* Tofor, Nerthus, vol. 4, p. 201.

1903. *Cnemidorphorus sexlineatus sexlineatus* Brown, Proc. Acad. Nat. Sci. Phila., p. 546.—Burt and Burt, Amer. Mus. Novitates, no. 381, 1929, p. 9.—Taylor, Univ. Kansas Sci. Bull., vol. 19, 1929, p. 64.

General notes.—During the early half of the past century, various workers, particularly those of Europe, have referred specimens from certain localities definitely outside of the range of *sexlineatus* to this form. These errors have been amplified by certain later writers who have secured their information from the earlier publications. The most important point in the history of *sexlineatus* follow in chronological order.

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[12] This report is from McPherson County, Kans., and *sexlineatus* is the only form of *Cnemidophorus* inhabiting the region. In a recent letter Doctor Cragin writes that he feels that the identification is correct, but that the locality data may be in error. This seems very likely since the specimen was not personally collected by Doctor Cragin.

The 6-lined race runner was described by Linnaeus in 1766 as a species of *Lacerta* and between that date and 1839 it was referred to a number of genera. In 1836 Holbrook wrote of his "*Ameiva sex-lineata*" as follows: "This animal was certainly first described by Linnaeus * * * from a specimen sent him by Dr. Garden of Charleston, who furnished him with numerous rare specimens of plants and animals from Carolina. * * * It is impossible to understand what led him to consider this animal as the Lion Lizard of Catesby (vol. 2, pl. 68), with which it neither agrees in colour, habits, nor geographical distribution. * * * It is remarkable that most naturalists since Linnaeus have copied this error, and have given the same reference."

In 1839 Duméril and Bibron placed *sexlineatus* in the genus *Cnemidophorus* and in 1843, Fitzinger (p. 20) designated this lizard as the type species of his genus *Aspidoscelis*, which however, has never been recognized.

In their list of the specimens in the Paris Museum, Duméril and Duméril (1851, p. 116) recorded *C. sexlineatus* from the following localities: Savannah, Ga.; Vera Cruz, Mexico; Habana, Cuba; Charleston, S. C.; New Orleans, La.; and Martinique in the West Indies. The reports from the United States may have been correct, but the one from Vera Cruz may have been based on either *gularis*, *deppii*, or *guttatus;* the one from Habana, Cuba, was probably based on a specimen of *Ameiva auberi;* and, likewise, the one from "Martinique" must have been based on an *Ameiva*. Westphal-Castelnau (1870) apparently copied the errors of Duméril and Duméril, and in the same fashion Vilanova and Piera (1874) considered this species as "inhabiting not only parts of the United States, but of Mexico and Martinique as well."

In 1878 Yarrow and Henshaw (p. 1640) reported *sexlineatus* from southern California on the basis of a series of specimens (U.S.N.M. No. 8630), and from Los Angeles, Calif., on the basis of one specimen (U.S.N.M. No. 8631). Since both of these numbers were listed under *tessellatus* by Cope (1900), it is obvious that these reports were due to misidentifications. In 1866 Cope (p. 283) reported a series of specimens from near the city of Chihuahua, Mexico, with "six longitudinal stripes and unspotted interspaces" as *C. sexlineatus sexlineatus*, but an examination shows that they were really intergrades between *gularis* and *perplexus*, which are here recognized as subspecies of *sexlineatus*. Because of their close resemblance to each other at certain stages in the life history all three subspecies have been frequently confused as a glance at their respective tables of synonymy will show.

Diagnosis.—Structurally the 6-lined race runner is distinguished by its possession of four supraoculars, the absence of enlarged polygones or scutes on the postantebrachium, and its relatively small size. It retains a striped pattern throughout life and there are usually six, distinct, light lines on the back, although at times, especially in young examples, one or two, more or less faint and wavy, dorsal stripes may appear near the middorsal line. The third or upper lateral pair of stripes are placed closer to the stripes below them on each side than to each other and usually a more or less widened, yellowish, dull streak takes the place of a middorsal stripe. The ground color of the back varies, but it is usually brown, blackish, or olivaceous; the upper sides are often decidedly lighter than the back in western specimens, in which case the two lateral fields are in sharp contrast on each side, the lower lateral remaining darker. The latter condition is not seen in *gularis* or *perplexus*. The under surfaces are usually white, although sometimes they stain to blackish in preservatives, but they are never blue-black as in many specimens of *gularis*. Field spots are always absent in *sexlineatus*.

Description.—Snout blunt, rounded; nostril anterior to nasal suture; anterior nasal usually in contact with first upper labial, rarely with second; supraoculars normally 4; granules often not extending past the posterior border of the third supraocular; frontoparietals usually 2; parietals normally 3; anterior gulars rather small, uniform, or with enlarged medio-lateral or median patches; posterior gulars smaller; mesoptychial scales moderate, largest centrally, larger rows 2–7; postmesoptychial granules fine, some usually on edge of posterior gular fold.

Body moderately stout; ventral scutes arranged in 8 longitudinal and 28–38 transverse rows; dorsal granules moderately fine (east) to coarser (west); limbs well developed; brachials 4–8; antebrachials 2–5; brachials and antebrachials usually continuous at a point of contact; postantebrachium with small or slightly enlarged granules; femorals 4–8; tibials 2–4; femoral pores 12–30; tail elongate, tapering; caudal plates large, oblique, with moderate or weak longitudinal keels laterally.

Coloration moderately distinctive, variable; ventral parts purplish, blue, greenish, yellowish, immaculate white or brownish; tail light below, and darker, usually olivaceous, above; dorsum lined at all ages; stripes normally 6, with the vestige of an additional pair usually showing anteriorly on each side in a line extending along the lower edge of the tympanum and ending abruptly behind it; middorsal area usually with a more or less widened, dull, yellowish streak, but sometimes with an additional stripe or two; ground color of back variable, usually blackish, brown, gray or olivaceous; dorsal ground color sometimes in distinct contrast to lateral ground color; usually, however, area between dorsal stripes lighter on account of suffusion from the yellowish streak mentioned above; femora faintly reticulated with white or unicolor.

A series of 1,522 specimens has been studied, but the data given below were taken from only 216 of them: Body, 27–82 mm.; tail, 45–164; total length, 72–246; width of head, 4.5–12.0; length of tail as percentage of total length, 55.5–72.1; width of head as percentage of body length, 11.1–17.7; supraoculars, 3 in 2 specimens, 4 in 205 specimens, and 5 in 9 specimens; supraocular granules extending forward to the middle of the fourth supraocular in 13 specimens, to the anterior border of the fourth supraocular in 165 specimens, and to the middle of the third supraocular in 38 specimens; frontoparietals 2 in 195 specimens, 3 in 12 specimens, 4 in 7 specimens, and 5 in 2 specimens; preanals, 2 in 14 specimens, 3 in 102 specimens, 4 in 33 specimens, 5 in 3 specimens, 6 in 32 specimens, 7 in 6 specimens, 8 in 9 specimens, 9 in 8 specimens, 10 in 2 specimens, 11 in 2 specimens, 12 in 4 specimens, and 13 in one specimen. Cope (1900) mentioned that the three large anal plates are fused into one piece in two specimens from Florida (U.S.N.M. No. 15336), but that all other Florida specimens are "normal."

Variation.—Perhaps the most significant variation found in *sexlineatus* is geographical. Brown (1903, p. 546) recognized the close affinity with *perplexus* and wrote as follows: "Two specimens from Pecos do not differ materially from eastern examples, except in having coarser dorsal scales, but four others, collected at Seymour, Tex., have similarly coarse scales. The pale dorsal area shows a tendency to contract and take on the form of a median stripe. All of the differences are in the direction of *C. perplexus*." The dorsal scales are small and finely granular in examples from the Eastern United States, but they are usually enlarged in the area west of the Mississippi River and north of Texas. This coarse dorsal granulation in the west serves as an approach to *perplexus*, as indicated by Brown. These subspecies are found to intergrade in the Panhandle district. Much individual variation exists in regard to these granules in all geographical areas and it seems that little more than an *average* difference exists between the eastern and western specimens in spite of appearances. The postantebrachium is usually covered by small granules, having characteristically but a small patch of slightly enlarged ones. The patch may be so reduced as to become indistinguishable from the surrounding scales on the forearm or it may be so developed as to take on the character of small polygons.

At the point of intergradation with *gularis* there is a complete transition from the characteristic granules of *sexlineatus* to the larger, better developed, polygons that are usually found in that form.

The dorsal ground color is usually olivaceous, but in certain geographical areas, particularly the southern tip of Florida, the Tennessee region and Padre Island, off the east coast of Texas, the color becomes black and the rather characteristically widened, poorly defined, yellowish, middorsal streak becomes noticeably restricted and better defined so as to tend to produce the appearance of a moderately distinct middorsal stripe. Since this variation occurs in widely separated localities, it is not thought to have especial taxonomic significance. The variation in the position of the upper (third) laterals seems to have much more importance in this respect, since it is the approach of these two stripes toward the middorsal line that marks, in part, the transition to *perplexus*. This tendency and the fading and loss of the yellowish middorsal streak is clearly evident at the point of intergradation between the two.

The ventral coloration of *sexlineatus* is like that of *perplexus* but differs from that of typical *gularis* in the absence of a deep bluish suffusion. Perfect transition from white to blue-black is seen at the point of intergradation between *sexlineatus* and *gularis* in Texas and Oklahoma.

Range.—This lizard is distributed over an unusually large area. It inhabits the lower levels in the Eastern United States from Maryland west to the southern tip of Lake Michigan, northwest through southern Wisconsin to southwestern South Dakota, southwest to north central Colorado, south on the eastern side of the mountains to southern Colorado and the panhandles of Oklahoma and Texas, and southeast to the section of the Gulf coast lying just north of the mouth of the Rio Grande.

A large number of records are available for *sexlineatus*, but there is a surprising lack of them from many areas. The reports will be presented below by States in an alphabetical series.

ALABAMA.—Autauga County (*Autaugaville*, U.S.N.M.). Baldwin County (*General Report*, Loding, 1922, p. 24). Calhoun County (*Anniston*, Dunn, 1920, p. 136). Cullman County (*Ardell*, U.S.N.M.). Greene County (*Eutaw*, Yarrow, 1882, p. 43, U.S.N.M.). Henry County (*Abbeville*, U.S.N.M.). Jackson County (*Sand Mountain*, Holt, 1924, p. 100). Lee County (*Auburn*, U.S.N.M.). Lowndes County (*Haynesville*, U.S.N.M.). Mobile County (*Mobile*, Loding, 1922, p. 24, M.C.Z., A.N.S.P.). Montgomery County (*Montgomery*, Yarrow, 1882, p. 44, U.S.N.M.). Tuscaloosa County (*Holt*, Loding, 1922, p. 24, Mich.).

ARKANSAS.—Crawford County (*Mulberry*, K. U.). Garland County (*Hot Springs*, Strecker, 1924, p. 37, U.S.N.M., Baylor). Jefferson County (*Pine Bluff*, Hurter and Strecker, 1909, p. 23, U.S.N.M.). Lafayette County (*Lewisville*, K. U.). Lawrence County (*Imboden*, F.M.N.H.). Little River County (*2 miles north of Ashdown*, Burt, A.M.N.H.). Pike County (*3 miles south of Mena*, Ortenburger, 1929, p. 10, Okla.). Polk County (*3 miles south of Mena*, Ortenburger, 1929, p. 10, Okla.; *4 miles west of Board Camp*, Ortenburger, 1929, p. 10, Okla.). Prairie County (*Devall Bluff*, K. U.). Pulaski County (*General Report*, U.S.N.M.). Sebastian County (*Fort Smith*, Yarrow, 1882, p. 43, U.S.N.M., Stanford).

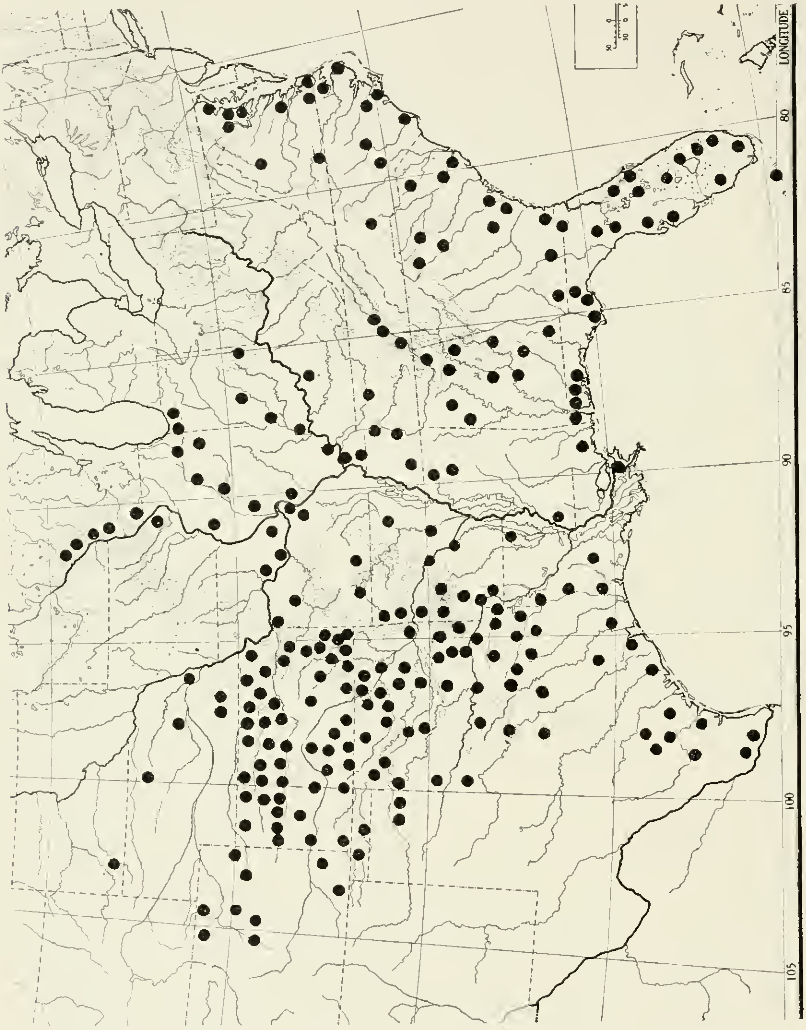

FIGURE 20.—MAP SHOWING THE LOCALITY RECORDS (COUNTY REPORTS) FOR CNEMIDOPHORUS SEXLINEATUS SEXLINEATUS

Washington County (*Fayetteville*, Hurter and Strecker, 1909, p. 23, F.M.N.H.).

COLORADO.—Adams County (*Barr*, Ellis and Henderson, 1915, p. 260). Denver County (*Denver*, Ellis and Henderson, 1913, p. 78). Jefferson County (*Golden*, Cary, 1911, p. 40). Larimer County (*Arkins*, U.S.N.M.). Las Animas County (*Corrizo Creek*, Ellis and Henderson, 1913, p. 78; *Ponia, near Trinidad*, Ellis and Henderson, 1913, p. 78). Prowers County (*Lamar*, Mich.). Washington County (*Akron*, Mich.). Weld County (*Greeley*, Ellis and Henderson, 1913, p. 78.). Yuma County (*Wray*, Ellis and Henderson, 1913, p. 78, A.M.N.H.).

CONNECTICUT.—Yarrow (1882, p. 44) reported a specimen from Middletown, Middlesex County, but this record does not seem to be backed by a specimen in the United States National Museum at the present time. Babcock (1920, p. 74) has written as follows: "The striped lizard reported by E. Smith (1899) as a 'hearsay' record from Connecticut occurs normally from Maryland to Florida."

DISTRICT OF COLUMBIA.—(*Terra Cotta*, East, 1927, p. 399, U.S.N.M.).

FLORIDA.—Alachua County (*Gainesville*, A.M.N.H., Mich.; *Micanopy*, Yarrow, 1882, p. 43, U.S.N.M.). Brevard County (*Canaveral*, A.M.N.H.; *Eau Gallie*, A.M.N.H., M.C.Z.; *Fort Lauderdale*, U.S.N.M.; *Georgiana*, Yarrow, 1882, p. 44, U.S.N.M.; *Indian River City*, U.S.N.M., Mich.). Broward County (*Hallandale*, M.C.Z.; *Pompano*, M.C.Z.). Dade County (*Miami*, A.N.S.P.). Duval County (*Arlington*, Yarrow, 1882, p. 44, U.S.N.M., M.C.Z.; *Cedar Creek*, Hallinan, 1923, p. 19; *Eastport*, A.M.N.H.; *Jacksonville*, Deckert, 1918, p. 31, A.M.N.H.). Escambia County (*Pensacola*, Yarrow, 1882, p. 43, U.S.N.M., M.C.Z., A.N.S.P.). Franklin County (*St. Vincent's Sound*, A.M.N.H.). Jefferson County (*Lake Miccosulee*, F.M.N.H.). Lake County (*Lake Harris*, Cope, 1900, p. 597, U.S.N.M.). Lee County (*Fort Myers*, A.M.N.H.; *Labelle*, Mich.). Manatee County (*Egmont Key*, F.M.N.H.; *Lemon City*, U.S.N.M.; *Little Sarasota Bay*, Yarrow, 1882, p. 44; *Miakka*, U.S.N.M.). Marion County (*General Report*, F.M.N.H., Carnegie; *Eureka*, A.M.N.H., Mich.). Monroe County (*Big Pine Key*, Fowler, 1906, p. 111; *Boca Chica Key*, Fowler, 1906, p. 111; *Grassy Key*, Fowler, 1906, p. 111; *Indian Key*, Yarrow, 1882, p. 43; *Key Vacas*, Fowler, 1906, p. 111; *Key West*, Cope, 1900, p. 597, U.S.N.M., M.C.Z., F.M.N.H., C.A.S., A.N.S.P.; *Knights Key*, Fowler, 1906, p. 111; *New Found Harbor, second key southwest of Big Pine Key*, U.S.N.M.). Orange County (*Oakland*, Loennberg, 1894, p. 321; *Orlando*, Loennberg, 1894, p. 321). Palm Beach County (*Lake Worth*, U.S.N.M.; *West Palm Beach*, M.C.Z.). Pasco County (*Argo*, A.N.S.P.). Pinellas County (*Clearwater*, Yarrow, 1882, p. 44.

U.S.N.M.; *Point Pinellas*, U.S.N.M.; *Seminole*, Mich.; *Seven Oaks*, A.M.N.H.). Polk County (*Auburndale*, U.S.N.M.; *Eustis Lake*, U.S.N.M.). Santa Rosa County (*Santa Rosa Island*, U.S.N.M.). St. Lucie County (*Sebastian*, M.C.Z.). Volusia County (*Enterprise*, Mich.; *Volusia*, Cope, 1887, p. 65, A.N.S.P.). Wakulla County (*Gulf Coast south of Tallahassee*, F.M.N.H.).

GEORGIA.—Baldwin County (*Milledgeville*, Yarrow, 1882, p. 43, U.S.N.M., M.C.Z.). Berrien County (*Nashville*, Yarrow, 1882, p. 44, U.S.N.M.). Camden County (*St. Marys*, Cope, 1900, p. 597, U.S.N.M.). Charlton County (*Billy's Island*, *Honey Island*, and *Minne Lake Island*, *Okefinokee Swamp*, Wright and Funkhouser, 1915, p. 129). Chatham County (*Savannah*, Cope, 1900, p. 597, U.S.N.M., M.C.Z.). Grady County (*Beachton*, F.M.N.H.). Turner County (*Ashburn*, A.M.N.H.).

ILLINOIS.—Hardin County (Garman, 1892, p. 256, listed an uncertain record from "Cave in Rock," which is not to be accepted until verified). Henderson County (*General Report*, U.S.N.M.). Kankakee County (*Illinoi*, F.M.N.H.). La Salle County (*Ottawa*, Garman, 1892, p. 256). Marshall County (*Henry*, Garman, 1892, p. 256). Mason County (*Topeka*, Iowa State). Morgan County (*Meredosia*, Weed, 1923, p. 48). St. Clair County (*Bluffs near Bluff Lake*, Hurter, 1893, p. 259).

INDIANA.—Franklin County (*General Report*, Hughes, 1885, p. 41, "I have seen only one of these specimens from the county"). Knox County (Hay, 1893, p. 545, "This species is included in the fauna of Indiana on the testimony of Mr. Robert Ridgway of the National Museum. He writes that while he was collecting snakes at *Monteur's Pond, near Wheatland*, he climbed a buttonbush to snare a big water snake. While thus engaged he saw a specimen of what he is positive is this species, with the appearance of which he was previously very familiar." This record served as the basis of Myers's, 1926, p. 286, report of *sexlineatus* from Indiana. A specimen from this county is now in the collection of the Museum of Comparative Zoölogy). Monroe County (*Bloomington*, U.S.N.M., Hay, 1893, p. 545, wrote that "Mr. A. W. Butler has informed me that he found this species in a small collection sent him from Bloomington. I have not seen the specimen." A general report for the county was given by McAtee, 1907, p. 11). Lake County (*Clarke Station*, F.M.N.H.; *Edgmoor*, F.M.N.H.; *Millers*, M.C.Z., F.M.N.H.; *Pine*, F.M.N.H.). Porter County (*Dune Park*, F.M.N.H., Mich.; *Mineral Springs*, F.M.N.H.). Posey County (*New Harmony*, M.C.Z.).

IOWA.—Jackson County (*Bellevue*, Cope, 1900, U.S.N.M.).

KANSAS.—Anderson County (*Bank of Birdshaw Creek, 6 miles south of Garnett*, K.U.). Barber County (*Sun City*, K.U.). Bourbon County (*Fort Scott*, K.U.). Cherokee County (*General Report*, K.U.). Clark County (*Ashland*, Burt). Comanche County (*Robbins pasture*, K.U.). Cowley County (*Arkansas City, K.U.; Silver Creek, 11 miles southeast of Winfield*, Burt). Crawford County (*Pitsburgh*, Blanchard). Dickinson County (*Carlton*, K. U.). Doniphan County (*Sandy Point, Doniphan Lake*, K.U.). Douglas County (*Cameron's Bluff, near Lawrence*, K.U.).; *Kaw River at Lawrence*, Burt; *Lawrence*, K.U.; A.M.N.H., Burt). Edwards County (*Trousdale*, K.U.). Ellis County (*General Report*, Burt). Franklin County (*Chippewa Hills, 8 miles southwest of Ottawa*, Gloyd, 1928, p. 119, Ottawa Univ.; *Woods near bank of Pottawatomie River between Lane and Greeley*, Gloyd, 1928, p. 119, Ottawa Univ.). Geary County (*Fort Riley*, Cragin, 1881, p. 117). Gove County (*General Report*, U.S.N.M., K.U.). Graham County (*General Report*, K.U.). Grant County (*General Report*, K.U.). Greenwood County (*town of Fall River*, U.S.N.M., K.U., Burt; *1 mile southeast of Fall River*, Burt). Hamilton County (*Syracuse*, U.S.N.M.). Harper County (*Anthony*, K.U.). Harvey County (*General Report*, K.U.). Hodgemann County (*Jetmore*, Ottawa Univ.). Jewell County (*Mankato*, K.U.). Kingman County (*Kingman*, K.U.). Labette County (*General Report*, U.S.N.M., K.U.). Lane County (*Pendemis*, K.U.). Lincoln County (*Lincoln*, Burt, A.M.N.H.). Logan County (*Elkader*, K.U.). Marion County (*Florence*, K.U.). Marshall County (*Sand pit between Waterville and Blue Rapids*, Burt). McPherson County (*Battle Hill*, Burt; *Twin Mounds*, Burt). Miami County (*General Report*, K.U.). Montgomery County (*Independence*, K.U.; *Wayside*, K.U.). Morton County (*Elkhart*, K.U.; *Walsh Ranch*, K.U.). Norton County (*Norton*, Burt). Osborne County (*Alton*, Burt). Ottawa County (*4 miles southwest of Minneapolis near "Rock City"*, Burt; *Rocky Fern, 6 miles southwest of Minneapolis*, Burt). Philips County (*Long Island*, A.M.N.H., K.U.). Pottawatomie County (*St. Marys*, Burt.) Pratt County (*Cario*, U.S.N.M.; *Pratt*, K.U.). Rawlins County (*Atwood*, K.U.: *McDonald*, K.U.). Republic County (*Agenda*, K.U.). Riley County (*Manhattan*. Jewell, Mich.; *Wildcat region west of Manhattan*, Jewell). Rooks County (*General Report*, K.S.A.C.). Rush County (*Nekoma*, K.U.). Russell County (*General Report*, U.S.N.M., K.U.) Shawnee County (*Topeka*, Washburn). Stafford County (*Little Salt Marsh*, K.U.; *Southwest part of county*, K.U.). Trego County (*Lerrington Ranch*, K.U., C.A.S.). Wallace County (*Smoky Hill River at Wallace*, M.C.Z., K.S.A.C.).

Washington County (*2 miles east of Haddam*, Burt, Mich., A.M.N.H.; *5 miles north of Haddam*, Burt, Mich.; *1 mile south of Haddam*, Burt, Mich.; *8 miles southeast of Haddam*, Burt, Mich.; *2 miles southwest of Haddam*, Burt). Wilson County (*Little Bear Mound near Neodesha*, Burt, Mich.; *Railroad tracks at Neodesha*, Burt, Mich., A.M.N.H.; *Railroad tracks at New Albany*, Burt, A.M.N.H.).

KENTUCKY.—Ballard County (*General Report*, Funkhouser, 1925, p. 78). Edmonson County (*Near Mammoth Cave*, Mich.). Hickman County (*General Report*, Funkhouser, 1925, p. 78).

LOUISIANA.—Beauregard County (*15 miles north of Longville*, Burt, A.M.N.H.). Caddo County (*Forbing*, Strecker and Frierson, 1926, p. 7; Gayle, F.M.N.H., Baylor, Jewell; *Shreveport*, U.S.N.M.). De Soto County (*Frierson*, Strecker and Frierson, 1926, p. 7, Baylor). Lafayette County (*Lafayette*, U.S.N.M.). Morehouse County (*Mer Rouge*, U.S.N.M.). Orleans County (*New Orleans*, Yarrow, 1882, p. 43, U.S.N.M.). Vernon County (*5 miles south of Leesville*, Burt, A.M.N.H.).

MARYLAND.—Baltimore City County (*Baltimore*, M.C.Z.). Calvert County (*Chesapeake Beach*, East, 1927, p. 399, U.S.N.M.). Prince Georges County (*Beltsville*, U.S.N.M.; *Junction of Defense and Crain Highways*, East, 1927, p. 399). St. Marys County (*Piney Point*, Yarrow, 1882, p. 43, U.S.N.M.; *Point Lookout*, Cope, 1900, p. 597, U.S.N.M.).

MISSISSIPPI.—Adams County (*Washington*, U.S.N.M.). Hancock County (*Bay St. Louis*, U.S.N.M.). Harrison County (*Heartsease, near Biloxi*, Corrington, 1927, p. 100). Lafayette County (*University*, Potter, 1920, p. 83, Mich.). Marshall County (*Holly Springs*, Mich.).

MISSOURI.—Jackson County (*General Report*, Hurter, 1911, p. 139). Jefferson County (*Pevely*, Strecker, 1924, p. 37, U.S.N.M., M.C.Z., Baylor). Johnson County (*General Report*, Hurter, 1911, p. 139). Pike County (*General Report*, Hurter, 1911, p. 139). Randolph County (*General Report*, Hurter, 1911, p. 139). Stone County (*Marvel Cave*, U.S.N.M.). St. Louis County (*St. Louis*, Hurter, 1893, p. 259, U.S.N.M., M.C.Z., A.N.S.P.). Taney County (*General Report*, Hurter, 1911, p. 139, U.S.N.M.). Warren County (*General Report*, Hurter, 1911, p. 139).

NEBRASKA.—Brown County (*Long Pine*, Cope, 1900, p. 597, U.S.N.M.). Douglas County, (*Omaha*, A.M.N.H.). Franklin County (*Riverton*, Burt, A.M.N.H.) Platte County (*Loup Fork in the sand hills*, U.S.N.M.). Webster County (*4 miles northwest of Red Cloud*, Burt, A.M.N.H.).

NORTH CAROLINA.—Brunswick County (*General Report*, Brimley, 1915, p. 200.) Buncombe County (*Black Mountain*, Brimley, 1915, p. 200). Camden County (*Fort Mason*, Yarrow, 1882, p. 44), Carteret County (*Beaufort*, M.C.Z.). Catawba County (*General Report*, M.C.Z.). Cumberland County (*Andrews*, Brimley, 1915, p. 200). Dare County (*Hatteras, Hatteras Island*, U.S.N.M.). Lenoir County (*Kingston*, Yarrow, 1882, p. 43, U.S.N.M.). Moore County (*Southern Pines*, Brimley, 1915, p. 200, A.M.N.H.). New Hanover County (*Wilmington*, U.S.N.M.). Orange County (*Chapel Hill*, Brimley, 1915, p. 200). Wake County (*Raleigh*, Gadow, 1906, p. 302, A.M.N.H., Baylor, C.A.S., Mich., Stanford).

OKLAHOMA.—Adair County (*4 miles northwest of Watts*, Ortenburger, 1929, p. 27, Okla.). Alfalfa County (*General Report*, Okla.). Caddo County (*General Report*, Ortenburger, 1926*b*, p. 94, Okla.). Choctaw County (*General Report*, Ortenburger, 1926*b*, p. 94, Okla.). Cimmaron County (*7 miles south of Boise City*, Ortenburger, 1927, p. 47, Okla.; *3 miles north of Kenton*, Ortenburger, 1927, p. 47, Okla.). Cleveland County (*Noble*, F.M.N.H., Okla.). Comanche County (*Mount Scott*, U.S.N.M., Okla.). Creek County (*Sapulpa*, A.M.N.H.). Dewey County (*General Report*, Okla.). Harmon County (*7 miles southwest of Hollis*, Okla., Mich.). Hughes County (*4 miles southeast of Non*, Burt, Mich.). Kay County (*General Report*, Ortenburger, 1926*b*, p. 94, Okla.) Latimer County (*General Report*, Okla.). Le Flore County (*Wister*, Carnegie, Okla.). McCurtain County (*Between Bethel and Broken Bow*, F.M.N.H., Okla.). Murray County (*Arbuckle Mountains*, Ortenburger, 1926*a*, p. 145, Okla.). Okmulgee County (*General Report*, Force, 1925, p. 25, Okla., K.U., Mich.). Osage County (*7 miles west of Skiatook*, Ortenburger, 1929, p. 27, Okla.). Pawnee County (*General Report*, Okla.). Payne County (*General Report*, Ortenburger, 1926*b*, p. 94, F.M.N.H.). Pushmataha County (*General Report*, Ortenburger, 1926*b*, p. 94, Okla.). Roger Mills County (*General Report*, Okla.). Sequouah County (*1 mile west of Muldrow*, Ortenburger, 1929, p. 27, Okla.). Texas County (*General Report*, Ortenburger, 1927, p. 47, Okla.). Tulsa County (*Red Fork*, U.S.N.M.; *Tulsa*, Okla., Gloyd). Woods County (*Whitehorse Springs*, F.M.N.H.). Woodward County (*Fort Supply*, Cope, 1893, p. 387, Okla.).

PENNSYLVANIA.—According to Roddy (1928, p. 51), *sexlineatus* occurs in Lancaster County in the Lower Susquehanna Valley. No specimens were mentioned specifically in the report and none are apparently available from the State as a whole. Therefore the writer follows Netting (1930, p. 172) in tentatively withholding the species from the State faunal test.

SOUTH CAROLINA.—Anderson County (*Anderson*, A.N.S.P.). Beaufort County (*Bluffton*, M.C.Z.). Charleston County (*Charleston*, Daudin, 1802, p. 84; *Mount Pleasant*, U.S.N.M.). Darlington

County (*Society Hill*, Yarrow, 1882, p. 43, U.S.N.M.). Dorchester County (*Summerville*, A.M.N.H.). Edgefield County (*Edgefield*, anonymous, 1915, p. 479). Greenwood County (*Greenwood*, Pickens, 1927, 110). Laurens County (*Clinton*, Pickens, 1927, p. 110).

SOUTH DAKOTA.—Washington County (*Sand hills*, Over, 1923, p. 20, U.S.N.M.)

TENNESEE.—Davidson County (*Nashville*, U.S.N.M.). Decatur County (*Perryville*, K.U.). Fayette County (*Somerville*, Blanchard, 1922, p. 7, Mich.). Hamilton County (*Chattanooga*, Rhoads, 1895, p. 296). Henry County (*Henry*, Blanchard, 1922, p. 7, Mich.). Rhea County (*Spring City*, Dunn, 1920, p. 136). Roane County (specimen was reported by Yarrow, 1882, p. 43, from "Rome Co., Tennessee," and since there is no such in the State, this county was probably meant).

TEXAS.—Anderson County (*Long Lake*, Bailey, 1905, p. 44, U.S.N.M.). Bastrop County (*Bastrop*, Cragin, 1884, p. 8). Baylor County (*Seymour*, Brown, 1903, p. 546). Bexar County (*San Antonio*, Yarrow, 1882, p. 43, U.S.N.M.; *Somerset*, U.S.N.M.). Cass County (*1 mile northwest of Atlanta*, Burt, A.M.N.H.). Clay County (*Henrietta*, Bailey, 1905, p. 44, U.S.M.N., F.M.N.H.). Comal County (*New Braunfels*, Yarrow, 1882, p. 43). Cooke County (*General Report*, Cope, 1900, p. 597, U.S.N.M.). Dallas County (*Dallas*, M.C.Z., Mich., Carnegie, A.N.S.P.). Duval County (*General Report*, Boulenger, 1887, p. 505). Eastland County (*Cisco*, K.U.). Galveston County (*Galveston*, Cope, 1900, p. 597). Goliad County (*General Report*, U.S.N.M.). Harrison County (*Waskom*, Bailey, 1905, p. 44, U.S.N.M.). Hemphill County (*Canadian*, Bailey, 1905, p. 44, U.S.N.M., F.M.N.H.). Henderson County (*Chandler*, Strecker, 1926*d*, p. 5). Hildago County (*Mercedes*, Carnegie). Hunt County (*Greenville*, K.U.). Kendall County (*Eastern part near Comal Co. line*, Strecker, 1926*b*, p. 5). Lamar County (*Arthur*, U.S.N.M.). Liberty County (*General Report*, Strecker, 1926a, p. 2). Matagorda County (*Bay City*, Carnegie). McLennan County (*Waco*, Strecker, 1902, p. 97, U.S.N.M., Baylor, Carnegie). Nacogdoches County (*Nacogdoches*, Bailey, 1905, p. 44, U.S.N.M.). Nueces County (*Padre Island*, Bailey, 1905, p. 44, U.S.N.M.). Palo Pinto County (*Brazos*, U.S.N.M.). Refugio County (*Refugio*, Carnegie). Roberts County (*Miami*, Cope, 1893, p. 387). Rusk County (*Church Hill*, U.S.N.M.). Starr County (*Riogrande*, U.S.N.M.). Tarrant County (*Fort Worth region*, Strecker, 1929*b*, p. 13). Upshur County (*Big Sandy*, U.S.N.M.; *Gilmer*, Yarrow, 1882, p. 43). Wilbarger County (*Vernon region*, Strecker, 1929*a*, p. 6).

VIRGINIA.—Elizabeth City County (*Hampton*, U.S.N.M.). Henrico County (*Richmond*, M.C.Z.). Mecklenburg County (*Nelson*, Dunn, 1918, p. 23). Nansemond County (*Nansemond*, Dunn, 1918, 23; *Suffolk*, U.S.N.M.). Nelson County (*Midway Mills*, Dunn, 1920, p. 136). Norfolk County (*Carolina*, Dunn, 1918, p. 23; *Elizabeth*, Dunn, 1918, p. 23; *Norfolk*, Yarrow, 1882, p. 43, U.S.N.M.)

WISCONSIN.—Crawford County (*Reed*, F.M.N.H.). Grant County (*General Report*, Pope and Dickinson, 1928, p. 44). Pepin County (*General Report*, Pope and Dickinson, 1928, p. 44). Pierce County (*Prescott*, U.S.N.M.). Vernon County (*General Report*, Pope and Dickinson, 1928, p. 44).

Habitat.—Because of the extensive distribution, much has been written concerning the habitat and habits of *sexlineatus*. "It is a very lively little animal, choosing dry and sandy places for its residence, and is frequently met with in the neighborhood of plantations, or near fences and hedges," according to Holbrook (1836, p. 65). In Missouri, "They like high and dry stony localities," as stated by Hurter (1893, p. 259), who also reported it from "dry sandy regions" (1911, p. 139), and in Louisiana it is one of the least common lizards, "occuring only in sandy pine regions" (Beyer, 1900, p. 43). Strecker (1926b, p. 2) found it to be "very common in cut-over pine woods" in eastern Texas, but near Waco, it "seems partial to the wooded bottom lands" (1915, p. 24).

In Florida the 6-lined race runner is "common along sandy roadways and on high ground near gopher turtle burrows" as found by Deckert (1918, p. 31). On April 16, 1922, in the Cedar Creek locality of northern Florida, Hallinan (1923, p. 19) observed specimens going in and out of these burrows.

In the Okefinokee Swamp in Georgia "It is locally known as the 'race nag,' a name which, like many of the other names used by the inhabitants of the swamp, was strikingly descriptive * * * It appeared most abundantly in the plowed fields where the Lees had planted corn, peas, and goobers, and since these plowed fields were very sandy, the common name of sand lizard or sand swift is quite appropriate. They were commonly seen among the 'goober' vines where their colors blended well with the lights and shadows under the leaves." (Wright and Funkhouser, 1915.)

In Wisconsin "The favorite habitat appears to be upon the high, rocky hills * * * where it is rarely seen before June 1, but is abundant until September 1." (Pope and Dickinson, 1928, p. 44). However, it was reported from the "sand hills of Washington County," South Dakota, by Over (1923).

In the vicinity of Hot Springs, Ark., Strecker (1924, p. 37) found it to be abundant in the city dumping ground, where a number of specimens were collected in shallow forms under stones and sheets of tin. The writer found individuals in a like environment and in the same general situation at a country dump near Haddam, Washington County, Kans., in June, 1928.

In Tennessee "They are common in sandy situations and are always found on the ground" (Blanchard, 1922, p. 6), and in Kentucky they are usually found "in open country, along sandy banks, or in plowed fields." (Funkhouser, 1925, p. 78.)

In Kansas "It has been seen in the sand dunes along the Kansas River (Riley County), and has been taken in small numbers under flat, hilltop rocks." (Burt, 1927, p. 4.) The same author in his "Lizards of Kansas" (1928) wrote as follows: "The writer has often collected this lizard. It frequents a greater variety of habitats than all of the other Kansas species, and it seems that only a high moisture content of the surface soil restricts its distribution, since it has often been collected from rocky ledges and sandy areas, but only rarely from loamy situations. It has been found on rocky hillsides, open corn and wheat fields, in upland meadows, on low sandy river banks, about chalk cliffs, railroad embankments, roadbeds, sand dunes, isolated sand banks, occasional outcroppings of rock, and on the upper part of wooded hillsides. These creatures are often found close to dwellings, and are apparently able to adapt themselves to changes brought about by agricultural conditions.

"The 6-lined race runner is perhaps the most gregarious of all Kansas lizards. Specimens were nearly always found at certain places, even though the collector returned again and again, whereas, at points not far away, which looked equally attractive as a habitat, none were seen."

This lizard is an inhabitant of the lower levels only and does not occur far up in either the Rockies or Appalachians.

General behavior.—In the vicinity of Fort Macon, N. C., "these lizards appear early in April," as stated by Coues (1871, p. 47), "and may be found until cold weather in October." They spend the winter in hibernation in some protected niche and Kansas specimens disclosed early in the spring are inactive and often covered by a damp, black coating of earth, which wears off after a few days of activity.

Although Holbrook (1836, p. 65) found that *sexlineatus* "generally seeks its food toward the close of the day, when it may be seen in cornfields far from its usual retreat," the writer has found that Kansas specimens become active in the early morning, and continue their activity until about noon. In the afternoon fewer specimens are seen, and at evening most of the specimens seem to have retired to their burrows to spend the night. The race runner is apparently entirely diurnal in its habits. "Over night some at least remain in holes dug in the sand from which they may easily be taken early in the morning," according to Blanchard (1922, p. 6), who collected specimens in a sandy habitat in Tennessee. "The burrow is short and has two openings, and when the lizard is inside, one of these openings is partially filled with sand thrown out from within."

These lizards seems to prefer the bare furrows of plowed fields in the region of the Okefinokee Swamp in northern Georgia for sunning themselves. (Wright and Funkhouser, 1915.) They had dug their holes in the raised earth between the furrows and they darted into these when disturbed. These burrows extended in an irregular direction to a depth of eight or ten inches.

The field behavior of *sexlineatus* has been much observed. "Its motions are remarkably quick and it runs with great speed." (Holbrook, 1836, p. 65.) Specimens escape by running into brush or grass (Blanchard, 1922, p. 6) or cactus patches (Weed, 1923, p. 48). "They were abundant on the Florida Keys, where they were seen running swiftly through the grass. (Fowler, 1906, p. 111.) They soon hid in holes or among rocks. About the lagoon on Key West they were most common under low grassy vegetation where numerous insects, such as small grasshoppers, were observed." According to Wright and Funkhouser (1915) "this lizard, in spite of its swiftness, is easier to secure in the field than the other common species of the Okefinokee Swamp on account of the fact that it does not possess the disconcerting habit of dashing along fences and through underbrush." The writer, however, has found that specimens living near Lawrence, Kans., do possess the latter habit.

The 6-lined race runner possesses the climbing habit according to Holbrook (1836, p. 65), who wrote that "most usually it is seen on the ground in search of insects, but it will take to trees when pursued." This seems surprising as it is in conflict with later reports and the writer's observations. Cope (1880, p. 18) found that in Texas "it is entirely terrestrial in its habits." Hurter (1911, p.139) wrote that in Missouri "it never resorts to trees, but trusts to its swiftness and skill in dodging from one covert to another to escape its pursuers," and Blanchard (1922, p. 6), working in Tennessee, stated that "they are always found on the ground."

Food and feeding habits.—Surprisingly little is known about this subject. "Often this animal does not detect undesirable food until it is taken into the mouth. Such food is quickly ejected, and the lips are then usually wiped on the ground, the lizard displaying great discomfort. Members of this species are exceedingly voracious feeders, both in natural habitats and in captivity, and on warm days a considerable number of small insects were eaten in a very short time.[13]

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[13] Burt, 1928*b*, pp. 59–60.

"The many specimens used in the writer's experiments ate flesh flies, leaf hoppers, tree hoppers, harvestmen, skipper butterflies, lightning bugs, tarnished plant bugs, dingy cutworm moths, striped cucumber beetles, grasshoppers, tree crickets, houseflies, measuring worms, lacewings, green stinkbugs, alfalfa butterflies, and the corn ear-worm mouth, with relish. Ground beetles were eaten only when the elytra were removed, showing the lizard's preference for the softer bodied insects. Large butterflies, such as the swallowtails, were often killed, but not eaten. Lady beetles were always watched intently, but if taken into the mouth were rejected." "The race runner darts upon many victims in quick succession when at the height of its feeding activity." (Burt, 1928*b*, p. 65.)

It eats cockroaches and tiger beetles, according to Hartman (1906), and Ditmars (1907) noted that "adults are not averse to feasting on eggs of small birds that build their nests on the ground." In regard to the latter statement, the writer (1928*b*, p. 59) has written that "after considering the size of the lizard's mouth, it appears that only extremely small eggs, if any, would be eaten," and it seems that the lizard can not be a serious enemy to bird life in this respect.

Loennberg (1902, p. 35) found that the caecum is absent from the digestive tract of *sexlineatus*, and after the examination of a number of stomachs, concluded (p. 29) that the form is chiefly insectivorous, although some pieces of vegetable matter were found in the large intestine.

Of 29 specimens from Oklahoma examined by Force (1925, p. 26), 11 had empty stomachs. The remaining 18 contained Locustidae to the extent of 52 per cent; Arachnida, 15 per cent; Myrmicidae and Formicidae, 16 per cent; Elateridae, 3.5 per cent; larvae, 9 per cent; may fly nymphs, 1 per cent; and mosquito wigglers, 1 per cent.

The examination of the stomachs of 15 Kansas specimens (Burt, 1928*b*, p. 60) revealed the following in the contents: Grasshoppers, crickets, katydids, moths, measuring worms, beetles, bugs, ants, chalcid flies, ichneumon flies, tachinid flies, spiders, and land snails.

The race runner is fond of spiders and many small insects, especially grasshoppers and Lepidoptera. The finding of a total of 7 land snails in the stomach of the 15 Kansas specimens examined suggests that these snails may form a substantial part of the lizard's natural ménu.

Life history.—The eggs of *sexlineatus* are similar to those of *Sceloporus undulatus undulatus* (Brimley, 1903, p. 265), but somewhat larger, about 17 to 22 mm. long by 11 to 14 mm. broad, with a smooth skin to which the dirt does not adhere so readily as to the rough skin of the *Sceloporus* eggs, and hence they usually look much whiter. The markings on the embryo do not show until a week or two before hatching.

Working in the Okefinokee Swamp region of northern Georgia, Wright and Funkhouser (1915) found that eggs had been deposited between the furrows in a plowed field. Usually four or five eggs were together in holes from 4 to 12 inches deep. The eggs were about 16 mm. in length by 10 mm. in width, ellipsoidal, comparatively soft, semitranslucent, and almost salmon colored. They were neither smooth nor shining, but slightly rough and subpubescent. "Little data were secured on the life history or the breeding habits, but from the fact that the eggs were secured in June, and also from the fact that several of the specimens taken showed the blue abdomen characteristic of the breeding male,[14] it is evident that this month represents at least a part of the breeding and egg-laying season. Since, moreover, the reptilian developmental period is comparatively long, the bulk of ovulations must have been practically over, or some of the females taken would have been found with eggs, which was not the case."

Enemies.—The enemies of *sexlineatus* are little known. Pritchett (1903, p. 284) placed a specimen of this species in a cage containing the collared lizard, *Crotaphytus collaris.* Subsequent to this time the *Cnemidophorus* specimen disappeared, and it was concluded that the smaller lizard was devoured. Since the collared lizard is known to prey upon the desert whiptail, *Cnemidophorus tessellatus tessellatus*, this does not seem unlikely.

Specimens of the 6-lined race runner were found in the stomachs of two black snakes, *Coluber constrictor constrictor*, according to Wright and Funkhouser (1915, p. 130).

Affinities.—This form is most closely related to its subspecies, *gularis* and *perplexus*, and it is found to intergrade with them along common boundaries as discussed above.

Two opposed views may be advanced to explain the origin of the modern *sexlineatus.* The first would hold that it is the most primitive form in the whole genus, as suggested by Gadow (1906) and superficially supported by the theses of Matthew (1915, 1916).[15] In this case, *gularis* and *perplexus*, which are nearer the present center of distribution of the genus than *sexlineatus*, might logically be considered as its derivatives. The second theory would hold that

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[14] Colors are deeper during the mating season, but the natural variation in respect to the ventral coloration is great, as shown elsewhere, so the finding of some brilliantly colored specimens here in June, or even later in the year, does not seem unusual. Perhaps considerable time elapses between the breeding and egg-laying seasons (or dates). Also, it may be remarked that the period of incubation is not known.

[15] The following should not be regarded as a criticism of the general theses of Matthew (northern origin of southern forms) as based on fossil evidence, but it may be regarded as an expression of the theory that various modern species of the north may have but *secondarily invaded* this region—often becoming specialized in doing so—and thereby these may tend to show conclusive evidence of a *southern center of origin* as is the case here.

sexlineatus is one of the more specialized forms, and that it has descended from *gularis-perplexus* stock. Either theory might be correct, but for reasons to be given in the general discussion at the end of this work, it is apparently best to accept the latter one. It seems very probable that Barbour and Noble (1915, p. 420) are correct in saying that change of climate "forced the ancestral Teiids southward and they flourished and are now wholly confined to the tropics, except *sexlineatus*, which has secondarily invaded the Austroriparian zone of North America, and a few species which have pushed into temperate South America." Thus, even though the Teiidae originated in the north as suggested by Matthew, *sexlineatus* may have become modified from a southern ancestral stock before its secondary invasion of the eastern part of the United States.

This species retains the juvenile type of coloration everywhere, as shown by Cope (1900). It seems that Brown (1903, p. 547) was correct in maintaining that the scutellation of *tessellatus* is "almost identical" with that of the present form. Because of a fundamental difference in color pattern, the two are placed in different groups here, but are listed as coming from the same ancestral stock. In spite of the resemblances, it is surprising that Ellis and Henderson (1913, p. 76) should have written that the young of *tessellatus* are marked much like the adult of *sexlineatus*.

The intergradation between *perplexus* and *sexlineatus* is confined to a small area in western Texas and Oklahoma and possibly in eastern New Mexico, and in some cases *gularis-perplexus* intergrades are almost identical with *sexlineatus-perplexus* intergrades, as at Pecos in western Texas, so the problem arising in this region is very complex. The intergradation between *sexlineatus* and *gularis* occurs over an elongated line of contact and is much more extensive, apparently, than that of *perplexus* with *gularis*. This is due, perhaps, to a sharper delineation of habitat differences in the latter case, as well as to other factors. From the geographical position and proportional extent of intergradation, it seems that both *sexlineatus* and *perplexus* have risen from the central *gularis*. The intergradation between *sexlineatus* and *perplexus* is apparently only *secondary*, rather than primary like the intergradation of each of these forms and *gularis*. This is supported by the fact that the yellowish middorsal streak of *sexlineatus* occurs just as frequently in *gularis*, but disappears in *perplexus*, and that spots are often found on the sides of *perplexus* and *gularis*, but disappear in *sexlineatus*.

Although Ellis and Henderson (1913, p. 76) claimed that "The young of *gularis* are marked much like the adult of *sexlineatus*," it is found that spots are present in the lateral fields of some of the youngest specimens of *gularis* from certain areas and that they are absent from those fields in other specimens that are fully as large as the adult *sexlineatus*. The latter are, fortunately, usually identifiable on the character of the postantebrachial scutellation. Gadow (1906) failed to discriminate well between *sexlineatus* and *gularis*, apparently because of the small number of specimens that he examined. He admitted *sexlineatus* to Mexico, because of the loss of spots in certain specimens of *gularis* there. He also considered the question as to whether *sexlineatus* really intergrades with *deppii*, citing the specimens from Sauz, Chihuahua, as the "*sexlineatus*" to which the approach was made. These specimens are here considered as *perplexus*, so the question will be discussed elsewhere.

It appears that *sexlineatus*, then, is not closely related to *deppii*, but that it intergrades with *gularis* and *perplexus*. As has been shown, it differs more from *perplexus* than from *gularis*, and intergradation with the former is probably only secondary. Therefore, it is presumed that *sexlineatus* has descended from *gularis*, chiefly through the loss of spots in the lateral fields and by the reduction of the size of the postantebrachials.

CNEMIDOPHORUS SEXLINEATUS GULARIS (Baird and Girard)

SPOTTED RACE-RUNNER

1852. *Cnemidophorus gularis* Baird and Girard, Proc. Acad. Nat. Sci. Phila., p. 128 (type locality, "Indianola and the Valley of the Rio Grande del Norte," Texas; 14 cotypes, U.S.N.M. Nos. 3022 and 2989; Col. Graham, collector); Expl. Red River of La. (1852), 1853, p. 239.—Hallowell, Proc. Acad. Nat. Sci. Phila., 1854, p. 192.—Baird, Reptiles, in "U. S.-Mex. Boundary Surv.," 1859, p. 11; Reptiles, Pacific R. R. Surv. (Whipple and Ives Route), vol. 10, pt. 6, no. 4, 1859, p. 38.—Günther, Zool. Rec. for 1866, vol. 3, 1867, p. 123.—Hurter, Cat. Reptiles and Batr. Coll. in Mo., printed privately, 1883, p. 7.—Garman, Bull. Essex Inst., vol. 19, 1887, p. 129 (original), and p. 11 (reprint).—Boulenger, Zool. Rec. for 1891, vol. 28, 1892, "Reptilia," p. 7.—Strecker, Trans. Tex. Acad. Sci., vol. 4, 1902, p. 96.—Brown, Proc. Acad. Nat. Sci. Phila., 1903, p. 548.—Gadow, Proc. Roy. Soc. London, vol. 72, 1903, pp. 110, 121.—Stone, Proc. Acad. Nat. Sci. Phila., 1903, p. 540.—Gadow, Proc. Zool. Soc. London, 1905, pp. 195, 216.—Brooks, Trans. Texas Acad. Sci. for 1905, vol. 8, 1906, pp. 23, 33.—Strecker, Proc. Biol. Soc. Wash., vol. 21, 1908, pp. 49, 73, 89, 167.—Hurter and Strecker, Trans. Acad. Sci. St. Louis, vol. 18, 1909, p. 22.—Strecker, Baylor Univ. Bull., vol. 12, 1909, pp. 4, 14; vol. 13, 1910, p. 8; Trans. Acad. Sci. St. Louis, vol. 19, 1910, p. 76; Baylor Univ. Bull., vol. 18, 1915, p. 24.—Bradley, Sci. Monthly, vol. 8, 1919, p. 377.—Ruthven, Geog. Rev., vol. 10, 1920, p. 243.—Painter, Journ. Exp. Zool., vol. 34, 1921, p. 297.—Strecker, Bull. Sci. Soc. San Antonio, vol. 4, 1922, p. 20; Baylor Univ. Bull., vol. 27, 1924, p. 36; Contr. Baylor Univ. Mus., vol. 6, 1926, p. 5; vol. 7, 1926, p. 5; vol. 9, 1926, p. 2; vol. 10, 1927, p. 10; vol. 12, 1927, p. 9; vol. 15, 1928, p. 4; vol. 16, 1928, p. 12.—Burt, Trans. Acad. Sci. St. Louis, vol. 26, 1928, p. 40.—Strecker, Contr. Baylor Univ. Mus., no 19, 1929, pp. 5, 13.

1853. *Cnemidophorus gularis* (part) Hallowell, Reptiles, in Sitgreaves' "Rept. of an Exp. down the Zuni and Colo. Rivers," p. 145.—Cope, Amer. Nat., vol. 25, 1891, pp. 1135-1136; Amer. Nat., vol. 26, 1892, p. 522.—Stone and Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 32.—Bailey. N. Amer. Fauna, vol. 25, 1905, p. 44.—Ditmars, Reptile Book, 1907, p. 187.—Stejneger and Barbour, Check List N. A. Amph. and Reptiles, 1917, p. 67; Check List N. A. Amph. and Reptiles, ed. 2, 1923, p. 71.—Pratt, Man. Vert. Animals U. S., 1923, p. 204.

1854. *Cnemidophorus guttatus* Hallowell (not of Wiegmann), Proc. Acad. Nat. Sci. Phila., p. 192 (type locality, "Texas").

1856. *Cnemidophorus sexlineatus* (part) Lichtenstein, Nomenclator Berol., p. 13.

1858. *Cnemidophorus inornatus* Baird, Proc. Acad. Nat. Sci. Phila., p. 255 (type locality, "Pesquieria Grande, New Leon," Mexico; 2 cotypes, U.S.N.M. No. 3032, Lt. Couch, collector); Reptiles, in "U. S.-Mex. Boundary Surv.", 1859, p. 11.—Cope, Bull. U. S. Nat. Mus., vol. 1, 1875, p. 45; Proc. Amer. Philos. Soc, vol. 17, 1877, p. 93.—Yarrow, Bull. U. S. Nat. Mus., vol. 24, 1882, p. 188.—Garman, Bull Essex Inst., vol. 16, 1884, p. 12.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 360.—Günther, Reptilia and Batr., in "Biol. Cent. Amer.," 1885, p. 29.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 45; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 40; Amer. Nat., vol. 30, 1896, p. 101; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 590.—Gadow, Proc. Zool. Soc. London, 1906, p. 373.

1869. *Cnemidophorus mexicanus* Peters, Monatsber. Berlin Akad. Wiss., p. 62 (type locality, "Mexico"; 3 cotypes, Mus. Berol. No. 6209).—Günther, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—Fischer, Oster-Progr. Akad. Gymn. Hamburg, 1883, p. 2.—Garman, Bull. Essex Inst., vol. 16, 1884, p. 13.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—Van Denburgh, Proc. Acad. Nat. Sci. Phila., 1897, p. 463.—Gadow, Proc. Roy. Soc. London, vol. 72, 1903, p. 116; Proc. Zool. Soc. London, 1905, p. 195; 1906, p. 358; Through Southern Mexico, Witherby and Co., 1908, pp. 235, 270; Zool. Jahrb., vol. 29, 1910, p. 706.

1870. *Cnemidofhorus sexlineatus* Duges, La Naturaleza, ser. 1, vol. 1, p. 144.

1874. *Cnemidophorus sexlineatus gularis* (part) Bocourt, Miss. Sci. Mexique et Amer. cent., vol. 3, p. 278.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 597.

1874. *Cnemidophorus sexlineatus mexicanus* Bocourt, Miss. Sci. Mexique et Amer. cent., vol. 3, p. 281, pl. 20c, fig. 7.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 366; Cat. Liz. British Mus., vol. 3, 1887, p. 505.

1877. *Cnemidophorus angusticeps* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 95 (type locality, "Yucatan," Mexico; 3 cotypes, U.S.N.M. Nos. 24876–24878; A. Schott, collector).—O'Shaughnessy, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—Gadow, Proc. Zool. Soc. London, 1906, p. 375.

1877. *Cnemidophorus communis* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 95 (type locality, "Colima, Guadalaxara and Cordova," Mexico; "Coban," Guatemala; and "San Antonio," Texas; cotypes, lost or misplaced); vol. 18, 1877, pp. 261, 265.—O'Shaughnessy, Zool. Rec. for 1877, vol. 14, "Reptilia," 1879, p. 6.—Sumichrast, La Naturaleza, ser. 1, vol. 6, 1884, p. 39.—Cope, Proc. Amer. Philos. Soc., vol. 22, 1885, p. 380; vol. 23, 1886, p. 283.—Ferrari-Perez, Proc. U. S. Nat. Mus., vol. 9, 1886, p. 195.—Van Denburgh, Proc. Acad. Nat. Sci. Phila., 1897, p. 463.—Gadow, Proc. Zool. Soc. London, 1906, p. 337; Zool. Jahrb., vol. 29, 1910, p. 706.

1877. *Cnemidophorus costatus* Cope, Proc. Amer. Philos. Soc., vol. 17, p. 95 (type locality, "Mexico"; type specimen, U.S.N.M. No. 31359, M. Boncard, collector).—O'Shaughnessy, Zool. Rec. for 1877, vol. 14, 1879, "Reptilia," p. 6—Günther, Reptilia and Batr., in "Biol. Cent.-Amer.", 1885, p. 26.—Ferrari-Perez, Proc. U. S. Nat. Mus., vol. 9, 1886, p. 195.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—Gadow, Proc. Zool. Soc. London, 1906, p. 375.

1878. *Cnemidophorus sexlineatus* Müller, Verh. Naturf. Ges. Basel, vol. 6, p. 626; Verh. Naturf. Ges. Basel, vol. 7, 1881, pp. 157, 292.—Cope, Proc. Amer. Philos. Soc., 1885, vol. 22, p. 380.—Ferrari-Perez, Proc. U. S. Nat. Mus., vol. 9, 1886, p. 195.—Cope, Proc. U. S. Nat. Mus., vol. 11, 1888, p. 397.—Ives, Proc. Acad. Nat. Sci. Phila., 1891, p. 459.—Duges, La Naturaleza, ser. 2, vol. 1, 1891, p. 119; vol. 2, 1897, pp. 295, 480.—Herrara, Cat. Col. Rept. y Batr. Mus. Nac. (Mexico), ed. 1, 1895, p. 21.—McLain, Contr. Neotropical Herpetol., printed privately, 1899, p. 2.—Herrara, Cat. Col. Rept. y Batr. Mus. Nac. (Mexico), ed. 2, 1905, p. 21.—Gadow, Science, vol. 22, 1905, p. 638.

1885. *Cnemidophorus sexlineatus* (part) Günther, Reptilia and Batr., in Biol. Centr.-Amer., p. 25.

1885. *Cnemidophorus sexlineatus angusticeps* Boulenger, Cat. Liz. British Mus., vol. 2, p. 366.

1885. *Cnemidophorus sexlineatus costatus* Boulenger, Cat. Liz. British Mus., vol. 2, p. 366.

1885. *Cnemidophorus bocourtii* Boulenger, Cat. Liz. British Mus., vol. 2, p. 367 (type locality, "California; Mexico"; 2 cotypes, B.M.N.H., California. 1856. 4. 9. 4–5; 1 cotype, Mexico. 1857. 10.28.81).

1885. *Cnemidophorus mariarum* Günther, Reptilia and Batr., in "Biol. Cent.-Amer.", p. 28 (type locality, "Mexico, Tres Marias Islands"; 5 cotypes, B.M.N.H., 1881.10.1. 81–82. 86–88).—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 368; Zool. Rec. for 1885, 1886, "Reptilia," p. 14.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44.—Van Denburgh, Proc. Acad. Nat. Sci. Phila., vol. 49, 1897, p. 463.—Stejneger, N. Amer. Fauna, vol. 14, 1899, p. 67.—Mocquard, Nouv. Arch. Mus. Paris, ser. 4, vol. 1, 1899, p. 315.—Gadow, Proc. Zool. Soc. London, 1906, p. 328.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 14, 1914, p. 149.—Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 15, 1926, p. 199.

1886. *Cnemidophorus sexlineatus sexlineatus* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (part); Bull. U. S. Nat. Mus., vol. 32, 1887, p. 44, (all).

1886. *Cnemidophorus sexlineatus guttatus* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *perplexus*).

1886. *Cnemidophorus sexlineatus, subsp. no. 3,* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *perplexus*).

1886. *Cnemidophorus sexlineatus, subsp. no. 4,* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *perplexus*).

1886. *Cnemidophorus sexlineatus, subsp. no. 5,* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *perplexus*).

1886. *Cnemidophorus sexlineatus tigris* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (type locality, "City of Chihuahua," Chihuahua, Mexico), (intergrades with *perplexus*).

1886. *Cnemidophorus lineatissimus* Ferrari-Perez, Proc. U. S. Nat. Mus., vol. 9, p. 196 (Puebla).

1887. *Cnemidophorus sexlineatus gularis* Cope, Bull. U. S. Nat. Mus., vol. 32, p. 44.—Burt and Burt, Amer. Mus. Novitates, No. 381, 1929, p. 9.

1887. *Cnemidophorus sexlineatus communis* Cope, Bull. U. S. Nat. Mus., vol. 32, p. 44.

1891. *Cnemidophorus gularis scalaris* (intergrades with *perplexus*) Cope, Amer. Nat., vol. 25, p. 1135, (*nomen nudem*); Trans. Amer. Philos. Soc., vol. 17, 1892, p. 47 (type locality, "Mexican Plateau, south of Chihuahua" and "City of Chihuahua," Mexico; 5 cotypes, U.S.N.M. No. 8319, and 2 cotypes, U.S.N.M. No. 14302; John Potts, collector); Proc. Acad. Nat. Sci. Phila., 1892, p. 335.—Boulenger, Zool. Rec. for 1892, vol. 29, "Reptilia," 1893, p. 23.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 605.

1891. *Cnemidophorus gularis semifasciatus* Cope, Amer. Nat., vol. 25, p. 1136, (*nomen nudem*); vol. 26, 1892, p. 522; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 49 (type locality, "Coahuila," Mexico; type specimen, U.S.N.M. No. 9248, Lt. Couch, collector).—Boulenger, Zool. Rec. for 1892, vol. 29, "Reptilia," 1893, p. 23.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 609.

1891. *Cnemidophorus gularis communis* Cope, Amer. Nat., vol. 25, p. 1135; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 46; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 601.

1891. *Cnemidophorus gularis costatus* Cope, Amer. Nat., vol. 25, p. 1136; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 50; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 601.

1892. *Cnemidophorus gularis gularis* Cope, Proc. Acad. Nat. Sci. Phila., p. 334.—Ortenburger, Copeia, no. 156, 1926, p. 145; Proc. Okla. Acad. Sci., vol. 6, pt. 1, 1926, p. 94.—Force, Proc. Okla. Acad. Sci., vol. 8, 1928, p. 78; Copeia, no. 2, 1930, p. 28.

1892. *Cnemidophorus gularis angusticeps* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 46; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 601.

1892. *Cnemidophorus gularis mariarum* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 46; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 601.

1892. *Cnemidophorus gularis scalous* Cope, Amer. Nat., vol. 26, p. 522, (*nomen nudum*).

1892. *Cnemidophorus gularis sericeus* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 48 (type locality, "San Diego, Texas"; type specimen, U.S.N.M. No. 15650; Wm. Taylor. collector).—Boulenger, Zool. Rec. for 1892, vol. 29, "Reptilia," 1893, p. 23.—Cope, Ann. Rept. U. S. Mus. for 1898, 1900, p. 607.—Burt, Proc. Biol. Soc. Wash., vol. 42, p. 154.

1892. *Cnemidophorus gularis gularis verus* (intergrades with *perplexus*) Cope, Trans. Amer. Philos. Soc., vol. 17, p. 45 (type locality, "City of Chihuahua," Chihuahua, Mexico); Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 604.

1892. *Cnemidophorus gularis gularis obsoletus* (intergrades with *perplexus*) Cope, Trans. Amer. Philos. Soc., vol. 17, p. 45, (type locality, "City of Chihuahua," Chihuahua, Mexico); Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 604.

1899. *Cnemidophorus gularis mexicanus* Stejneger, N. Amer. Fauna, vol. 14, p. 68.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol 4, 1914, p. 149.—Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 15, 1926, p. 199.

1900. *Cnemidophorus gularis gularis* (part) Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 602.—Gadow, Proc. Zool. Soc. London, 1906, p. 331.

1903. *Cnemidophorus bocourti* Gadow, Proc. Roy. Soc. London, vol. 72, p. 117; Proc. Zool. Soc. London, 1905, p. 195; Through Southern Mexico, Witherby and Co., 1908, p. 279.

1903. *Cnemidophorus semifasciatus* Gadow, Proc. Roy. Soc. London, vol. 72, p. 119; Proc. Zool. Soc. London, 1906, p. 334.

1906. *Cnemidophorus gularis meeki* Gadow, Proc. Zool. Soc. London, p. 332, (type localities, "Montemorelos, Garza Valdez, La Cruz, and San Juan," Northeastern Mexico; 3 cotypes, B.M.N.H. Garza Valdez. 1906. 7. 19. 31–33; 2 cotypes, Montemorelos, F.M.N.H. No. 1294; 6 cotypes, Garza Valdez, F.M.N.H. No. 1288; 3 cotypes, San Juan, F.M.N.H. No 1334).

1906. *Cnemidophorus scalaris* Gadow, Proc. Zool. Soc. London, p. 335, (part).

1906. *Cnemidophorus communis australis* Gadow, Proc. Zool. Soc. London, p. 352 (type localities, "Lagunas and Cuicatlan," Oaxaca, Mexico; 4 cotypes, "Lagunas," F.M.N.H. No. 1488; 2 cotypes, "Lagunas," B.M.N.H. 1906. 7. 19. 16–17; 8 cotypes, F.M.N.H. No. 1022 and 3 cotypes, "Cuicatlan," B.M.N.H. 1906. 7. 19. 11–13).

1906. *Cnemidophorus communis bocourti* Gadow, Proc. Zool. Soc. London, p. 356.

1906. *Cnemidophorus communis copei* Gadow, Proc. Zool. Soc. London, p. 346 (type locality, Colima and Oaxaca, Mexico; 1 cotype, "Colima," B.M.N.H. 1906. 7. 19. 5; 2 cotypes, "Manzanillo," F.M.N.H. No 2531; 1 cotypes, "San Domingo de Guzman," B.M.N.H. 1890. 10. 10.71).

1906. *Cnemidophorus communis occidentalis* (part) Gadow, Proc. Zool. Soc. London, p. 339 (type localities numerous and listed below in connection with data pertaining to the cotypes, northern Mexico; 1 cotype, "Lake Santa Maria, northwest Chihuahua," F.M.N.H. No. 2534; 2 cotypes, "Lerdo," F.M.N.H. No. 1401: 4 cotypes, "Durango," F.M.N.H. No. 1284; 2 cotypes, "Durango," B.M.N.H. 1906. 7. 19. 9–10; 11 cotypes, "Ixtlan," B.M.N.H. 1892. 2. 8. 33–43; 5 cotypes, "Sierra de Nayarit," B.M.N.H. 1892. 2. 8.44–48; 6 cotypes, "Presidio," B.M.N.H. 1883. 4. 5. 22–27; 2 cotypes, "Zapotlan," F.M.N.H. No. 2535; 8 cotypes, "Puebla," F.M.N.H. Nos. 1321–1322; 5 cotypes, "Puebla," B.M.N.H. 1906. 7. 19. 18–22; 2 cotypes, "Patzcuaro," F.M.N.H. Nos. 1024–1025; 5 cotypes, "Acambaro," F.M.N.H. Nos. 1018–1019: 3 cotypes, "San Juan del Rio," F. M. N. H. No. 1027; 6 cotypes, "Guanajuato," B.M.N.H. 1898. 7. 19. 2–7).

1906. *Cneminophorus mexicanus typica* Gadow, Proc. Zool. Soc. London, p. 360 (type locality, "Oaxaca").

1906. *Cnemidophorus mexicanus balsas* Gadow, Proc. Zool. Soc. London, p. 363 (type locality, "Basin of the Balsas River," Mexico; 13 cotypes, "Cuernavaca," B.M.N.H. 1906.6.1.71–83; 4 cotypes, "Cuautla," B.M.N.H. 1906.7.19.27–30; 7 cotypes, "Cuautla," F.M.N.H. Nos. 1305–1306; 3 cotypes, "Yautepec," F.M.N.H. No. 1350; 1 cotype, "Yautepec," B.M.N.H. 1906.7.19.23; 3 cotypes, "Jojutla," B.M.N.H. 1906.7.19.24–26; 4 cotypes, "Jojutla," F.M.N.H. No. 1289; 6 cotypes, "Puente de Ixtla," B.M.N.H. 1906.6.1.89–94; 7 cotypes, "Puente de Ixtla," F.M.N.H. Nos. 1016, 1026; 1 cotype, "Iguala," B.M.N.H. 1906.6.1.96; 3 cotypes, "Rio Balsas," B.M.N.H. 1901.6.1.68–70; 6 cotypes, "Chilpancingo," B.M.N.H. 1906.6.1.84–88, 95).

1921. *Cneminophorus gularis* Painter, Journ. Exp. Zool., vol. 34, p. 284.

1921. *Cnimedophorus gularis* Painter, Journ. Exp. Zool., vol. 34, p. 284.

Systematic notes.—The spotted race-runner was described by Baird and Girard in 1852. It was said to have the appearance of *sexlineatus*, differing in the "shorter body, better developed legs, smaller dorsal granules, and larger marginal scales of the subgular fold." All of these characters are insufficient to diagnose *gularis*, but it is sufficiently separated from its close relatives, *sexlineatus* and *perplexus*, by other characters. Because of their general resemblance to *gularis*, specimens in the Sonoran region of the United States and Mexico, as well as the typical form, have usually been identified as *gularis*, but for reasons given under *perplexus*, they are here considered as *perplexus*. This change restricts *gularis* to western Texas in the United States and to southern Chihuahua and Sonora in Mexico.

Within its subspecific limits *gularis* is highly variable and it seems that the influence of the environment on the coloration and scutellation can not be denied. In certain regions predominately spotted or cross-barred patterns appear, the amount of blue in the ventral coloration becomes modified, and the type of postantebrachial scalation is changed. In fact numerous striking combinations may be found. Thus, many *local phases* are produced and it is little wonder that certain workers, disregarding or overlooking the trivial nature of certain of these variants (with especial reference to their remarkable instability and frequent geographic repetition) have found fit to give them taxonomic designations.

During the period of its development, *gularis* goes through an intricate series of pattern stages, and while there is considerable individual variation, the evolution is in all cases essentially the same. The young are often unspotted, and in such, the appearance of spots in the lateral fields may be expected sooner or later. In certain individuals and regions spotting is retarded more than in others and at times the spotted phase is transformed into a tiger-barred one by the spreading of the spots to form crossbars with the stripes above and below them. This is often accompanied by a tendency for the dark ground color to encroach upon the longitudinal light stripes and to unite across them. Thus the whole aspect of the pattern may be changed, the emphasis being transferred from the longitudinal to the transverse. At other times the lines break into spots and disappear as longitudinal elements. This is accompanied by profuse spotting in the interspaces and the assumption of a dull, uniform ground color. The barred phase has been described as *scalaris* and is found in both *gularis* and *perplexus*, while the spotted phase has been called *bocourtii*. When series are examined it becomes apparent that the presence or absence of lines, spots, or crossbars in a specimen is not a reliable diagnostic feature.

As indicated above, the phases and variations of *gularis* have given rise to a large number of taxonomic designations. Since the color evolution seems essentially the same in all regions, treatment of the described forms under phase or variation seems unnecessary. Therefore, they are placed under five more or less arbitrary heads as follows: I, the forms from Texas and northeastern Mexico; II, the forms of Chihuahua; III, the "communis" group; IV, the "mexicanus" group; and V, the forms from uncertain localities.

I. The forms from Texas and northeastern Mexico are as follows: *Gularis*, *inornatus*, *guttatus*, *sericeus*, *semifasciatus*, and *meeki*. The first of these, *gularis*, was described from Texas. The types are typical of what is here considered as *gularis*, having enlarged scutes on the back of the forearm, a ventral patch of dark bluish and a widened middorsal area. The two specimens described as *inornatus* by Baird (1858) are from Nuevo Leon and differ from *gularis* in the absence of dorsal markings. An examination of the cotypes shows that they are both small (about 55 mm. from snout to anus) and that they are blackish and badly faded. As remarked by Gadow

(1906, p. 373), these specimens resemble certain unlined young of *guttatus*, and because of this Bocourt (1874, p. 270) even went so far as to suggest that "*C. inornatus* represents, perhaps, the young of *C. guttatus*" (of Wiegmann). Since, after more than 70 years, additional specimens of *inornatus* have not been found, it seems improbable that they represent a distinct race. From the standpoint of geography, it would appear that the cotypes should be either *tessellatus* or *gularis*. Moreover, the presence of four supraoculars in *inornatus* suggests these species, rather than the southern forms, *deppii* and *guttatus*, which usually have three. Since, the appearance of enlarged scutes on the face of the forearm excludes the possibility of identity with *tessellatus*, *inornatus* is placed in the synonymy of *gularis*, with which it is found to agree in all details of scutellation.

The *C. guttatus* of Hallowell (1854), described from Texas, represents the spotted phase of this form. It must not be confused with the *C. guttatus* of Wiegmann (1834), a distinct species, the existence of which Hallowell must have overlooked.

Cnemidophorus gularis sericeus was described from San Diego, Tex., by Cope (1892). Femoral and gular differences, which are often the result of individual variation, were cited in the original description to separate this form from *gularis*. A comparison of the type with the types of *gularis* shows no radical difference in the color pattern, although the posterior part of the back is becoming unicolor. A still greater development of this tendency is shown by the type of *septemvittatus*, which because of other differences, must be regarded as *perplexus*, rather than *gularis*. The form from Coahuila that was described as *semifasciatus* by Cope (1891, 1892) differs very little from *sericeus*, also, and a comparison of its type with the types of *gularis* and *scalaris* (to be discussed below) indicates all to be the same. *C. semifasciatus* represents a transition from *scalaris*, the cross-barred phase, to a phase in which the dark vestiges of the original ground color tend to disappear, leaving a poorly marked, nearly unicolor, pattern. Gadow (1906, p. 334) recognized that *sericeus* and *semifasciatus* were the same, but failed to link them with *gularis*. In series, transition from one phase to the other may be easily seen, so all three are held to be identical.

In describing *gularis* as a "small, rather slender species, inhabiting the arid plains with their spare vegetation of mesquite," Gadow (1906) was probably speaking of *perplexus*, rather than *gularis*, and it seems apparent that his conception of the "northern *gularis*" as a species rested upon specimens in the British Museum from Fort Lowell, Ariz., although he also listed the "typical" form from Duval County, Tex. His description of *C. gularis meeki* from northeastern Mexico is not surprising when viewed in this light, for the differences cited between *meeki* and *gularis* are those which actually exist between the present *gularis* and *perplexus*. These may be quoted as follows: "There is no doubt that the 13 specimens of *meeki* are closely allied to each other, and differ in the average from the typical, northern *gularis* by their larger forearm scutes * * * pink throat, decidedly strong and uniform (blue-) black pigmentation of the chest and abdomen, and * * * the tendency to develop a fourth pair of pale stripes in the mid-field besides the usual three pairs." Thus, it is seen that the description of *meeki* was the result of careful, although unfortunately misplaced, observation. As it is, *meeki* seems unquestionably a synonym of *gularis*.

II. The forms of Chihuahua are supposedly six in number, and were characterized by Cope (1886, p. 283) as follows:

1. Six longitudinal lines with no spots______________*C. sexlineatus sexlineatus.*
2. Six stripes, small white spots in fields_____________*C. sexlineatus guttatus.*
3. Six stripes, wider, very obscure; small obscure spots. *C. sexlineatus, subspecies no. 3.*
4. Six stripes, wider, spots enlarged to become confluent with the light stripes. *C. sexlineatus, subspecies no. 4.*
5. Stripes wider, spots confluent with them, so as to reduce the ground color to a series of cross-lines________________*C. sexlineatus, subspecies no. 5.*
6. The short, black, crossbars more or less confluent across the positions of the light stripes, forming transverse crossbands which are generally developed laterally__________________________________*C. sexlineatus tigris.*

It is obvious from the arrangement and the context of the above "key" that only one species is involved. It seems worthy of note that all of these transient color phases are here found in one general locality, the plains near the city of Chihuahua. An examination of the "types" shows that the specimens near the beginning of the series are all young and that those near the end are all adults.

In 1892 Cope (p. 45) considered the above *guttatus* as a synonym of *gularis*, but substituted for it a quadrinomial, *C. gularis gularis verus*. In addition, the subspecies nos. 3 and 4 became *C. gularis gularis obsoletus*, and the subspecies no. 5 plus "*tigris*" became *C. gularis scalaris*. That all of these are one seems amply demonstrated, but the question of whether they are *perplexus* or *gularis* still remains. An examination of the types shows some to be identifiable as one and some as the other. A combination of the dorsal pattern of *perplexus* and the blue-black ventral suffusion of *gularis* occurs, perhaps, most frequently. Therefore, these "forms" must be placed in the synonymy as intergrades between *gularis* and *perplexus*.

III. The "communis" group was developed chiefly by Gadow (1906) and consists of the following forms: *communis*, *copei*, *mariarum*, *bocourtii*, *australis*, and *occidentalis*.

C. communis was described by Cope in 1877 from specimens from Colima, Guadalajara, and Cordoba in Mexico; from Coban in Guatemala; and from San Antonio in Texas. The types have apparently been lost and the original description is none too definite, but the fact that specimens from such widely separated regions were considered as the same by a specialist who was always looking for new species seems to argue in itself against the retention of subsequently described "varieties" of *communis* as distinct units. Two recognizable phases of *communis* were given in the original description as follows: "I. With two rows of light spots in the spaces between the stripes in females, while in the males the stripes are broken into round spots to give a coloration like that of *guttatus*." It may be remarked that this phase appears often in series of *gularis*, and that it is not seen in young individuals. "II. With no spots and the bands unbroken." This is more or less typical of the young everywhere, but it is rarely seen in adults.

It is not surprising that Cope should have reported "*communis*" from many localities, but it is surprising that Gadow (1906) should have designated variety I as a new subspecies, *C. communis copei*, based on cotypes from Colima and Manzanillo in the state of Colima, and San Domingo de Guzman in Oaxaca. At the same time two specimens from Cozumel Island, off the coast of Quintana Roo, were also referred to the assemblage. It seems worth pointing out here that Cope (1886, p. 283) had already written that "*Communis* from southern Mexico has the coloration of the subspecies *guttatus* and *no. 4*, but differs from them in the possession of a frenoocular plate." The subspecies mentioned are from Chihuahua and have already been sufficiently identified with *gularis*. The frenoocular distinction is worthless since a frenoocular sometimes occurs on one side of a specimen's head and not on the other. Although Gadow (1906, p. 293) presumed that *communis* was stopped from an eastward migration in the state of Zacatecas, specimens are now available from that area and the appearance of like forms in Colima and Chihuahua indicates that an absolute barrier to eastward migration does not exist. Gadow (p. 293) wrote that "Cope's statement that his *communis* occurs also at Coban in Guatemala is as worthless as that of Bocourt that he has *mexicanus* from Salama in Guatemala." This supposition of Gadow's seems to be in error, since the writer has examined a fine series of *gularis* from the Departments of Jalapa and Guatemala (in Guatemala) to the south of the records in question. Therefore both the Coban and Salama reports are accepted here.

The second variety was not amply discussed by Gadow, who, although describing additional specimens as subspecies of *communis*, did not recognize a central form as *C. communis communis*. Since this second variety is obviously the young of the first variety, further comment seems unnecessary.

C. mariarum was described from the Tres Marias Islands, off the west coast of Nayarit, by Günther in 1885. A diagnosis was not given in the original description, but it was said that the caudals are weakly keeled and that the keels run nearly parallel to the lateral margins of the scale. A comparison of a large series of specimens from the Tres Marias Islands and the mainland of Mexico indicates that this character is valueless. The keels of all *gularis* are much weaker than those of *tessellatus*. Although the keels run "nearly parallel to the lateral margins of the scales," they are nevertheless oblique, and in some cases decidedly so. It was this, perhaps, that lead Van Denburgh (1897*a*, p. 463) to write that "A large number of lizards from Mazatlan, San Blas, and Tepic seem to be identical with Günther's specimens from the Tres Marias Islands. Whether they are also identical with Cope's *communis* and Peter's *mexicanus*, I have been unable to decide." Upon admitting *mariarum* to the mainland, Van Denburgh specified that "the upper lateral light lines are much farther apart than in *gularis*, causing the specimens to bear resemblance to *sexlineatus*." Since he was familiar chiefly with the *gularis* (=*perplexus*) of the Sonoran region, it was only logical for him to draw this distinction, which is, of course, useless here since it does not separate *gularis*, as here defined, from *mariarum*. Stejneger (1899) identified the mainland specimens as *C. gularis mexicanus*, thus confining *mariarum* to the Tres Marias Islands again, stating that "This is the only species of reptile hitherto collected which is peculiar to these islands." He also called attention to the "different keeling of the caudal scales" as the chief characteristic of the form. The spots in these specimens are always more or less poorly defined the yellowish middorsal streak is often unusually wide, the upper lateral stripes are sometimes obsolete, and the tails of the young are usually decidedly pink, but all of these characters are frequently seen in mainland specimens of *gularis*, and even of *perplexus* as well. They are also significantly varied in *mariarum* itself. Therefore, because of the slight degree of difference between *mariarum* and the bulk of *gularis*, and because of its identity with many mainland specimens, *mariarum* is here reduced to the synonymy of *gularis*, leaving *Tantilla nelsoni*, recently described by Slevin (1926, p. 200), as the one apparently distinct reptile from the region.

Cnemidophorus bocourtii was described by Boulenger (1885) from an indefinite locality, "California; Mexico." In tracing its affinity, it seems important that *bocourtii* was mentioned in the original description as sometimes having "traces of six longitudinal lines on the back." This and reference to an enlarged series of postantebrachials, and to a ventral patch of blackish-blue, serve to identify *bocourtii* with *gularis*. The chief characteristic of the species has been interpreted to be the loss of lines and the assumption of a sparsely spotted garb. The known specimens are all large, that is, adults. Gadow (1906, p. 277) reported *bocourtii* from near the town of Oaxaca, and (p. 117) said that "Structurally, this lizard is but a slight variety of *mexicanus*, with which it shares the same distribution, except that it is more partial to denser vegetation. It is spotted instead of cross-barred or striped." He also said that *bocourtii* is structually indistinguishable from many specimens of *occidentalis* (p. 357), but nevertheless considered it as "one of the most easily recognized forms of the *gularis* group." All of this tends to indicate that *bocourtii* is none too firmly fixed as a taxonomic entity. During this study it has been found that in some regions many of the adults are *bocourtii* and that everywhere the young are typical *gularis* (or *mexicanus*, as Gadow expresses it). Specimens of both types have been observed from the following localities in Mexico: Coahuila (*Sabinas*, U.S.N.M.); Oaxaca (*Oaxaca*, U.S.N.M.); Chiapas (*Ocozucuantla*, U.S.N.M.); and in Guatemala, Department of Jalapa (*El Rancho*, U.S.N.M., F.M. N.H.). Large spesimens from Guatemala, collected at El Progreso, Jalapa, and Guatemala, Guatemala (C.A.S.), are of the *bocourtii* type and no doubt the young are 6-lined as are those from El Rancho. Thus, *bocourtii* also becomes a synonym of *gularis*.

The original description of *Cnemidophorus communis australis* from Oaxaca by Gadow (1906) is very confusing and is so involved that it is sometimes contradictory. Thus, it is found that he recognized different variation in his discussion (p. 354) than in his "tables of comparison" (p. 329). In the latter he listed the brachials as 7–9 in number, the postantebrachials as granular, and the femoral pores as 19–26, but in the former it was said that the brachials are 8–10, the postantebrachials sometimes polygonal, and the femoral pores, 17–23. It was noted that *australis* differed from *copei* in the possession of an entirely granular forearm, but this character is highly variable, as Gadow himself maintained elsewhere, and variation from granules through polygones to scutes is often seen in series of *gularis* (as well as in *perplexus*).

The appearance of scutes chiefly in the large individuals and of granules chiefly in the young, tends to indicate a moderate differentiation of these scales during development. As to the significance of *australis*, Gadow wrote: "One might be inclined to assume that in the coastal district of Colima the transition from *immutabilis* (=*guttatus*) to *copei* takes place; just as in certain parts of Oaxaca there are large *Cnemidophori* which might be interpreted either as the most abberant clans of *communis* tending toward *bocourti* and *mexicanus*, or as abberant *immutabilis* and *guttatus*, which assume characters typical of *communis*. Such are the *C. communis australis*." Just why transition from *guttatus*, the large, intensified *deppii* with three supraoculars and a distinctive coloration, to *copei* or other members of the gularis stock, should be mentioned here is not apparent. Superficially these forms may resemble each other by assuming a spotted garb, but in *guttatus* the spots are confined to the dorsal region and in *gularis* the continuous lines of the sides are usually the first to break into spots or cross-bars. The latter do not appear in *guttatus*. Since *australis* does not occupy a distinctive range, and an examination of part of the cotypes shows them to be nothing but *gularis*, the form is not given recognition here.

The original description of Gadow's *C. communis occidentalis* is even more indefinite than his description of *australis*. Since a diagnosis is not given the following characteristics are taken from the key (p. 328): "Stripes dissolved into rows of pale spots; many longitudinal rows of pale and round spots, Mexico; forearm with scutes or polygones; humerals and femorals 5–7; chest and abdomen pale." An examination of a large series of cotypes in the collection of the Field Museum of Natural History shows that part of them are *perplexus*, although the most are *gularis*. It is surprising that the dissolution of the stripes into rows of spots should be emphasized as a key character, since all of the young cotypes are distinctly striped, occasionally even being entirely unspotted. The presence of scutes or polygones on the postantebrachium is not distinctive and the number of humerals and femorals is highly variable, the range given here being typical rather than differentiative. The chest and abdomen are pale in only part of the cotypes, those approaching *perplexus*, and in some the ventral suffusion is blue-black as is typical of *gularis* through the typical part of its range. A comparison of some of the smaller cotypes of *occidentalis* with the cotypes of *meeki* shows them to be identical, and the larger specimens are, as a rule, the same as one of the phases described from Chihuahua by Cope (1886), although occasionally much spotted, unstriped specimens which are without cross-bars, are seen. Thus, for apparent reasons, *occidentalis* can not be retained as a distinct entity.

IV. The "mexicanus" group, like the one just discussed, was largely developed by Gadow (1906). It consists of the following described forms: *Mexicanus*, *angusticeps*, *typica*, and *balsas*.

Cnemidophorus mexicanus was described by Peters (1869*b*, p. 62) with no other locality than "Mexico." It was said to be a close relative of *sexlineatus*, having six light stripes and an unspotted, black ground color. With this background of indefiniteness it is at once evident why there has been so much confusion over the form in later years. Günther (1885, p. 25) wrote that "having some doubt as to the propriety of including this among the synonyms of *sex-lineatus*, I asked Professor von Martens for information; and from his report it appears not only that the specimens of *mexicanus* are identical with those in the British Museum which were collected by Herr Forrer at Presidio, but also that Peters himself left a note on the bottle containing the types that they were not distinct from *C. gularis* (Baird and Girard)." This identity with the Presidio specimens of Sinaloa would seem to exclude the possibility of *mexicanus* being identical with *perplexus*. However, the southern limit of the Mexican habitat of *perplexus* in the west is still uncertain. In 1906, Gadow described *C. mexicanus typica* from specimens from Oaxaca, listing the "types of *C. mexicanus* Peters" under this heading. Oaxaca has already been mentioned as the home of Gadow's *bocourtii*. Moreover, Gadow said that "It is the irony of fate that the three types of *mexicanus* are all immature and show but little of the typical features * * * differing from those collected by myself by decidedly larger scutes on the posterior side of the forearm." This is interpreted to be an admission that young specimens of Gadow's "subspecies" could not be distinguished from each other, a conclusion forced upon the writer after the examination of a large series of Mexican specimens. Gadow also wrote (p. 360) that "A noteworthy character of these lizards is the complete absence of any pale spots, except those transitory faint spots in the fields of young specimens. In this respect they differ conspicuously from *communis* and its relations, with their numerous spots." Yet both *mexicanus* and the spotted *bocourtii* of the *communis* group were reported from Oaxaca. It has already been shown that the spotted type may give rise to a cross-barred phase. In these spotted and cross-barred forms of Oaxaca there is apparently no difference in size, in scutellation, or in color pattern of the young, and in old adults of both the pattern fades anteriorly to a greater extent than posteriorly. Because of this and because of the fact that both cross-barred and spotted phases appear in *gularis* and *perplexus* as a frequent variation in widely separated regions, *mexicanus* and "*typica*" are considered as identical with *gularis*.

Cnemidophorus angusticeps from Yucatan, insufficiently diagnosed from "*communis*" in the original description by Cope (1877, p. 95) is apparently nothing but a synonym of *gularis*. It is not unusual that the stripes "send off lateral processes and give the ground color a very broken character." An examination of the co-types shows that they have a patch of blue-black ventrally and that they possess the usual four supraoculars of *gularis*.

Cnemidophorus mexicanus balsas was described by Gadow (1906). He stated that *balsas* is a case of isolation, and is restricted to the Basin of the Balsas River in southern Mexico. "This is bounded on the north by an impassable barrier of high mountains, the southern fringe of the central plateau, and on the south by the Sierra Madre del Sur, the low pass of which, at Los Cajones, these lizards just manage to cross, but they do not descend beyond into the coastal region." The present work presents records which indicate a continuous distribution of these lizards throughout most of Mexico, and while they are no doubt restricted by high altitudes, as are other reptiles, a topographic map of the region surrounding the Balsas Basin shows an abundance of natural entrances to the place. Specimens of *gularis* have been secured south of Colima and, although perhaps avoiding the coast as indicated by Gadow, they no doubt range southward along the foothills of the mountains to the point where the Balsas River itself cuts through the Sierra Madre del Sur to flow to the Pacific Ocean. The presence of these lizards in the Balsas Basin indicates that they are able to ascend to higher levels from this point. An opening to the Basin seems to be evident from the east and north through Puebla, Hidalgo, and Queretaro to Guanajuato, and another, perhaps, directly from the north through the state of Mexico. Although not extending to the coast at Los Cajones, the form may occur along the foothills southward toward Oaxaca and Chiapas, thus giving another natural migration route. Therefore, it is doubtful if *balsas* can be "a case of isolation." The subspecies itself was diagnosed as having a strong collar, scutes on the forearm, and a less pronounced, more incipient tiger-pattern than *typica* in Oaxaca. Since there is nothing constantly definitive in these characteristics, *balsas* is not recognized here.

V. The forms from uncertain localities are two, *costatus* and *sealous*. The first of these, *costatus*, was described by Cope (1877, p. 95) from "Mexico" and has scarcely been mentioned since. It was said to have "no trace of stripes, the sides being brown, with black crossbars which join across the middle line in the lumbar region." An examination of the type shows that it is merely an old specimen of *gularis*.

The second form, *sealous*, was mentioned by name only as a subspecies of *gularis* by Cope in 1892 while discussing pattern evolution in *Cnemidophorus*. It is presumed that he intended to describe the form at a later date, as he did for *scalaris* and *semifasciatus*, which also appeared as *nomina nuda* at first.

Diagnosis.—The spotted race runner may usually be distinguished by the presence of a bluish ventral suffusion. When lined, there are four to eight stripes and the third (often upper lateral) pair on each side are usually placed closer to the stripes below them than to each other. A widened, yellowish, middorsal streak is usually apparent, and this, when present, separates *gularis* from *perplexus*. Certain specimens of *gularis* differ from *sexlineatus* by the presence of enlarged scutes or polygones on the posterior surface of the forearm, in the attainment of a body length of over 85 mm. (snout to anus), in the presence of spots in the lateral fields, or in the appearance of crossbars and reticulations on the sides. Any of these differences from *sexlineatus* is sufficient for separation.

Gularis differs from *deppii* and *guttatus* in the normal possession of four supraoculars instead of three. Moreover, the latter forms never have crossbars on the sides or enlarged scutes under the forearm.

Description.—Snout moderately pointed to blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraocular normally 4; supraocular granules often not extending forward past the anterior border of the fourth supraocular (north), but sometimes extending far forward (south); frontoparietals normally 2; parietals normally 3; anterior gulars moderate to large, graded, usually largest centrally; posterior gulars smaller, although sometimes secondarily enlarged just anterior to the first gular fold; mesoptychium usually, although not always, with rather scutes, these uniform or graded and often somewhat enlarged centrally, in 1–5 rows; postmesoptychial granules minute, usually hidden by posterior gular fold, seldom in view on edge of mesoptychium.

Body elongate; ventral plates in 8 longitudinal and 32–40 transverse rows; dorsal granules minute to large; limbs well developed; brachials 5–12; antebrachials 2–6; brachials more or less continuous with antebrachials at a point of contact; posterior side of forearm with granules, polygones or scutes; femorals 4–12; tibials 3–5; femoral pores 15–26; tail elongate, tapering; caudal scales smooth below, keeled above; lateral caudals moderately large, with series of more or less oblique, distinct, longitudinal keels, these usually much weaker than in *tessellatus*, often very weak.

Coloration highly variable; ventral surfaces usually with a dark blue suffusion, especially on the chest and abdomen, or only on one of these, but under parts sometimes light as in *sexlineatus* and *perplexus;* throat of breeding males often pinkish, of females darker, duller, sometimes bluish, but throat of both sexes usually uniformly white or yellowish; tail unspotted below, but either unicolor or reticulated above; femora normally unspotted in the common lined phase, but more or less distinctly spotted in the larger spotted or crossbarred phase; back lined or unlined; if lined, four to eight stripes present, and a widened, yellowish, middorsal streak usually in evidence; if unlined, vestiges of stripes may or may not be present; but size large and crossbars on spots always present; spots present or absent in the lateral fields of the young or in the lines themselves; ground color of back and sides often distinctly contrasted, that of the back lighter; sides brown, olivaceous, black, reddish or gray.

A total of 1.572 specimens of *gularis* have been examined and are all found to be remarkably uniform in most proportional and scutellational features. A specimen from Colima, Colima, Mexico (U.S.N.M. No. 58676), apparently is the largest one in collections. It measures as follows: Body, 164 mm.; tail, 320 (regenerated); total length, 484; width of head, 34; length of hind leg, 105. A representative series of 350 additional specimens gives the following range of variation: Body, 40–136 mm.; tail, 87–302; total length, 134–432; length of tail as percentage of total length, 63–76; width of head, 6–24; width of head as percentage of body length, 18.8–21.0); hind leg, 26–91; length of hind leg as percentage of body length, 58–78; supraoculars 4 in 336 specimens, 5 in 5 specimens, 4–5 in 8 specimens, and 4–6 in 1 specimen; supraocular granules not extending forward past the anterior border of the fourth supraocular in 42 specimens, extending to the middle of the third supraocular in 285 specimens, to the anterior border of the third supraocular in 22 specimens, and to the anterior border of the second supraocular in 1 specimen.

Variation.—Considerable geographical variation has been noted in the number of femoral pores and the position of the supraocular granules. In order to show this variation, a representative series from Guatemala, central Mexico, and Texas, has been studied. The following table shows that no definitive difference between these populations exists, but that a significant evolutionary trend has taken place with northward extention of the range. This trend toward reduction both in the number of femoral pores and in the number and forward extent of the supraocular granules is definitely toward the northern subspecies, *sexlineatus* and *perplexus*, with which *gularis* intergrades extensively along common boundaries.

Table showing the geographical variation in the number of femoral pores and in the on of the supraocular granules of C. sexlineatus gularis

Locality	Specimens	Pores	Supraocular granules			
			Percentage of specimens [1]			
			2	3	pt. 3	4
Guatemala	78	21–26		23.0	77.0	
Central Mexico	187	15–26	1.0	1.6	97.4	
Texas	85	14–20	1.2	1.2	50.5	47.1

[1] This refers to the forward extent of the supraocular granules and the numerals used denote the following conditions: 2= extending forward to the anterior border of the second supraocular; 3= extending forward to the anterior border of the third supraocular; pt. 3= extending forward to the middle of the third supraocular; 4= extending forward to the anterior border of the fourth supraocular.

Associated with these differences is a larger average maximum size in the adults from southern Mexico and Guatemala, as compared with those from Texas. Since very large specimens have been found in Coahuila and Colima, this, too, is only relative.

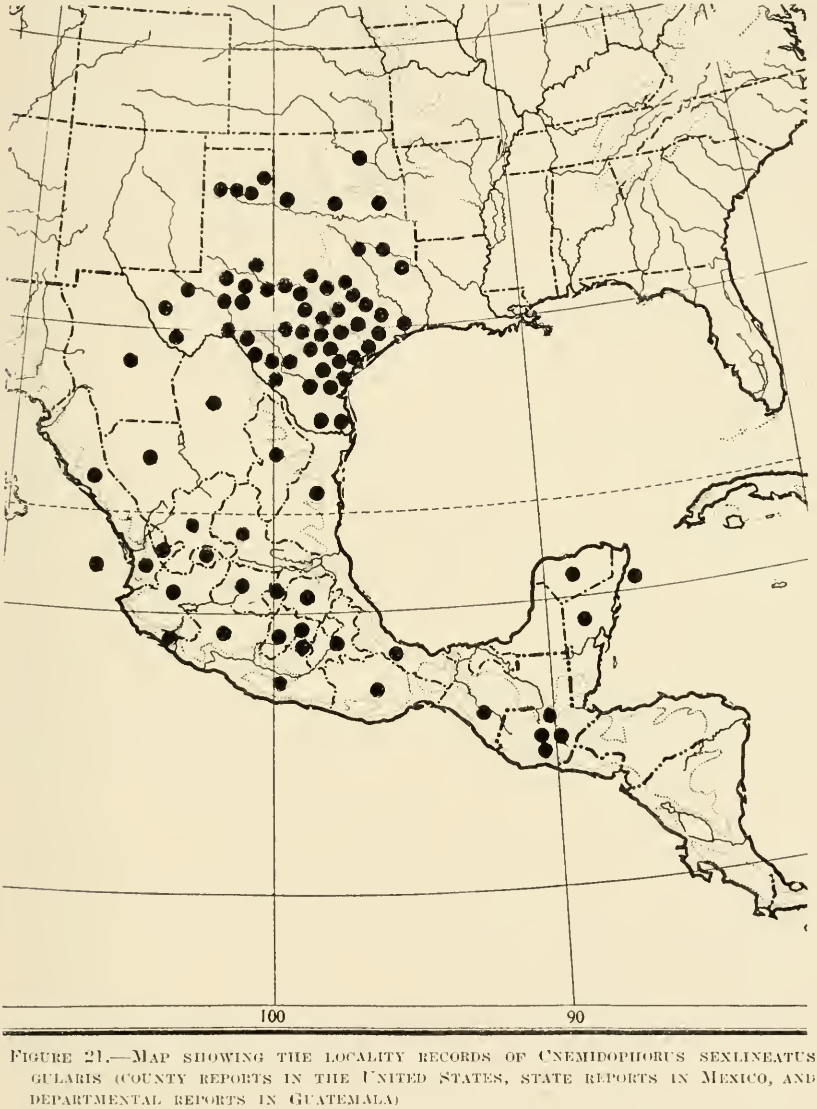

Figure 21.—Map showing the locality records of Cnemidophorus sexlineatus gularis (county reports in the United States, state reports in Mexico, and departmental reports in Guatemala)

Range.—The spotted race runner occupies an extensive and continuous range in the United States, Mexico, and Guatemala. It is found from eastern Oklahoma and Texas southward along the Mexican mainland to Quintana Roo and Guatemala, thence westward to the Pacific slope, northward to Sinaloa, northeast to the panhandle of Texas, and east to eastern Oklahoma. The records follow:

ARKANSAS.—Garland County (the specimens reported by Strecker, 1924, p. 548, from this county have been examined by the writer. One of these, U.S.N.M. No. 58818, has spots and enlarged postantebrachials and may be identified as *gularis*, but the other two, Nos. 58819–58820, are nearer to *sexlineatus*. There is little doubt that Garland County, Ark., is outside of the normal range of *gularis* and the record may be the result of secondary introduction of the species at this point).

OKLAHOMA.—Greer County (*General Report*, Okla.). Harmon County (*7 miles southwest of Hollis*, Mich., Okla.). Love County (*5 miles north of Thackerville*, Burt, A.M.N.H.; *Thackerville*, Burt, A.M.N.H.). Murray County (*Arbuckle Mountains*, Ortenburger, 1926*a*, p. 145, Okla.; *Daughtery*, F.M.N.H.). Pushmataha County (*General Report*, Ortenburger, 1926*b*, p. 94). Tulsa County (*Ortenburger*, 1926*b*, p. 94).

TEXAS.—Armstrong County (*Mulberry Canyon, 15 miles southwest of Goodnight*, Strecker, 1910, p. 8). Bell County (*1 mile south of Killeen*, Burt, " found dead in road, but not preserved "). Bexar County (*Fort Sam Houston*, Blanchard; *Helotes*, A.N.S.P.; *Leon Springs*, C.A.S.; *San Antonio*, Cope, 1877, p. 95, U.S.N.M., C.A.S., M.C.Z., A.N.S.P.; *Somerset*, U.S.N.M., K.U.). Bosque County (*Clifton*, Baylor, Carnegie). Brewster County (*Butcherknife*, Strecker, 1909*b*, p. 14; *Du Bois Canyon*, Strecker 1909*b*, p. 14; *Paisano*, Bailey 1905, p. 44, U.S.N.M., Baylor). Burnet County (*Burnet*, K.U., Baylor; *Marble Falls*, Mich.; *Post Mountain*, F.M.N.H.). Cameron County (*Brownsville*, Bailey, 1905, p. 44, U.S.N.M., M.C.Z., F.M.N.H., Mich., Carnegie, K.U.; *Santa Maria*, Carnegie; *Villa Nueva*, Mich.). Colorado County (*Columbus*, U.S.N.M.). Comal County (*New Braunfels*, U.S.N.M.). Comanche County (*Comanche*, A.N.S.P.). Concho County (*4 miles southeast of Eden*, Mich.). Crockett County (*Ft. Lancaster*, Bailey, 1905, p. 44, U.S.N.M.). Dallas County (*Dallas*, M.C.Z., Carnegie, A.N.S.P.). Dewitt County (*Cuero*, Bailey, 1905, p. 44, U.S.N.M.). Dimmit County (*Corrizo Springs*, U.S.N.M.). Donley County (*South of Clarendon*, A.N.S.P.). Duval County (*San Diego*, Cope, 1900, p. 608, U.S.N.M., A.N.S.P.). Falls County (*Gurley*, U.S.N.M. C.A.S.). Galveston County (*Galveston*, U.S.N.M.). Goliad County (*Charco*, A.M.N.H.). Guadalupe County (*General Report*, Mich.). Hays County (*San Marcos*, Stone, 1903, p. 541, Burt, A.M.N.H.; Baylor, A.N.S.P.; *8 miles west of San Marcos*, Burt, A.M.N.H.; *1 mile east of Wimberly*, Burt, A.M.N.H.). Hemphill County (*near Canadian*, Baird, 1859*b*., p. 38). Henderson County (*East bank of*

Trinity River, Strecker, 1926*d*, p. 3). Hildago County (*Lomita Ranch*, Bailey, 1905, p. 44, U.S.N.M., *McAllen*, A.M.N.H.; *Mercedes*, Carnegie). Jeff Davis County (*Cherry Canyon*, Mich.; *Davis Mountains*, Brown, 1903, p. 548, Mich.; *Fort Davis*, U.S.N.M., Mich.; *Musquiz Canyon*, Mich.; *Sleeping Lion Mountain*, Mich.). Jim Wells County (*Alice*, Bailey, 1905, p. 44, U.S.N.M.). Kendall County (*Boerne*, Strecker, 1926*b*, p. 5, C.A.S.; *Waring*, U.S.N.M.). Kerr County (*Kerrville*, Bailey, 1905, p. 44, U.S.N.M.). Kinney County (*Fort Clark*, U.S.N.M.). La Salle County (*Cotulla*, Bailey, 1905, p. 44, U.S.N.M.). Matagordo County (*Bay City*, Carnegie). Maverick County (*Eagle Pass*, Baird, 1859, p. 11, U.S.N.M., M.C.Z., K.U.). McCulloch County (*Brewster*, U.S.N.M.). McLennan County (*Falls of Bosque*, Baylor; *Hewitt*, C.A.S.; *Lathmore Pitt*, Baylor; *2 miles south of Lorena*, Burt, Mich.; *Waco*, Strecker, 1910*b*, p. 76, M.C.Z., Baylor, C.A.S., Carnegie, K.U.). Milam County (*Cameron*, U.S.N.M.). Mitchell County (*Colorado*, Baylor). Nueces County (*Corpus Christi*, Bailey, 1905, p. 44, U.S.N.M.). Randall County (*Canyon*, Carnegie). Reagan County (*10 miles west of Big Lake*, Burt, Mich.). Reeves County (*Barilla Camp*, Burt, Mich.; *15 miles east of Balmorhea*, Burt, Mich.; *Pecos*, Stone and Rehn, 1903, p. 33, A.N.S.P.; *Weinacht's Draw*, Mich.). Refugio County (*General Report*, Strecker, 1908*b*, p. 48). San Saba County (*5 miles west of San Saba*, Burt, Mich.). Somervell County (*General Report*, Strecker, 1926*e*, p. 2). Starr County (*Rio Grande*, Bailey, 1905, p. 44, U.S.N.M.; *Roma*, Bailey, 1905, p. 44, U.S.N.M.). Sutton County (*Sonora*, U.S.N.M.). Tarrant County (*Fort Worth*, Strecker, 1929*b*, p. 13, A.N.S.P.). Tom Green County (*Christoval*, Strecker and Williams, 1927, p. 9, Baylor; *4 miles southwest of Rankin*, Burt, Mich.; *San Angelo*, A.N.S.P.). Travis County (*Austin*, U.S.N.M.). Valverde County (*Comstock*, Bailey, 1905, p. 44, U.S.N.M.; *Mouth of Devil's River*, Bailey, 1905, p. 44, U.S.N.M.; *Painted Cave at mouth of Pecos River*, Bailey, 1905, p. 44.). Victoria County (*General Report*, Strecker, 1908*b*, p. 48, U.S.N.M.). Washington County (*Washington*, A.N.S.P.). Webb County (*Laredo*, Yarrow, 1882, p. 43, U.S.N.M., M.C.Z.). Wilbarger County (*Vernon region*, Strecker, 1926*a*, p. 5).

In Mexico the spotted race runner occurs very abundantly and it will probably be found to inhabit all of the States, except Lower California. It is, however, replaced in northern Sonora, Chihuahua and Coahuila by *perplexus* with which it intergrades in these areas. The available reports are listed below in an alphabetical series by States.

AGUASCALIENTES.—(*Chicalote*, U.S.N.M.).

CHIAPAS.—(*Ocozucuautla*, U.S.N.M.).

CHIHUAHUA.—(*Batopilas*, Cope, 1879, p. 261; *Chihuahua*, Cope, 1887, p. 44, U.S.N.M., F.M.N.H.; *Jimenez*, F.M.N.H.; *La Cruz*, Gadow, 1906, p. 332; Sauz, U.S.N.M.).

COAHUILA.—(*Jaral*, F.M.N.H.; *La Ventura*, U.S.N.M.; *Monclova*, U.S.N.M.; *Patos*, Cope, 1900, p. 610, U.S.N.M.; *Sabinas*, U.S.N.M.; *Saltillo*, U.S.N.M.; *Sierra Guadalupe*, U.S.N.M.).

COLIMA.—(*Colima*, Cope, 1877, p. 95, U.S.N.M., A.M.N.H., M.C.Z., C.A.S.; *East of Colima*, A.M.N.H.; *South of Colima*, A.M.N.H.; *Manzanillo*, Gadow, 1906, p. 277, U.S.N.M., F.M.N.H., Los Angeles; *Tapextles*, Los Angeles; *Tecoman*, A.M.N.H.; *1 mile north of Villa de Alvarez*, A.M.N.H.).

DURANGO.—(*Chocola*, U.S.N.M.; *Durango*, Gadow, 1906, p. 277, U.S.N.M., A.M.N.H.; *Lerdo*, Gadow, 1906, p. 277, F.M.N.H.).

FEDERAL DISTRICT.—(*Mexico City*, U.S.N.M.; *2 miles west of Xochimilco*, A.M.N.H.).

GUANAJUATO.—(*Acambaro*, Gadow, 1906, p. 277, F.M.N.H.; *Celaya*, Gadow, 1906, p. 277, U.S.N.M., F.M.N.H.; *Guanajuato*, Cope, 1879, p. 261, U.S.N.M.).

GUERRERO.—(*Chilpancingo*, Gadow, 1906, p. 277; *Iguala*, Gadow, 1906, p. 277; *Rio Balsas*, Gadow, 1906, p. 277, U.S.N.M.; *Rincon, south foot of Los Cajones*, Gadow, 1906, p. 277).

HIDALGO.—(*Ixmiquilpan*, U.S.N.M.).

JALISCO.—(*Ameca*, U.S.N.M.; *Atemajac*, U.S.N.M.; *Barranca Ibarra*, U.S.N.M.; *Bolanos*, U.S.N.M.; *Capulin*, A.M.N.H.; *El Aquilar Mine at Hostotipaquillo*, A.M.N.H.; *Elfuerte*, A.M.N.H.; *Guadalajara*, Cope, 1877, p. 95, U.S.N.M.; *Heujuquilla*, U.S.N.M.; *Northwest of Hostotipaquillo*, A.M.N.H.; *Jamay*, A.M.N.H.; *Lagos*, U.S.N.M., F.M.N.H.; *Oblatos*, A.M.N.H.; *Ocotlan*, F.M.N.H.; *Orendain*, A.M.N.H.; *Rio Blanco north of Zapotlan*, A.M.N.H.; *San Marcos*, U.S.N.M.; *Sierra de Nayarit*, Gadow, 1906, p. 118; *South of Tlaquetaque*, A.M.N.H.; *Tuxpan*, Gadow, 1906, p. 277, F.M.N.H.; *Vallarta*, A.M.N.H.; *Zapotlan*, Gadow, 1906, p. 277, F.M.N.H.).

MEXICO.—(*Toluca*, U.S.N.M.).

MICHOACAN.—(*Alvarado*, M.C.Z.; *Patzcuaro*, Gadow, 1906, p. 277, F.M.N.H.).

MORELOS.—(*Barranca, near Cuernavaca*, U.S.N.M.; *Cuatla*, Gadow, 1906, p. 277, F.M.N.H.; *Cuernavaca*, Gadow, 1906, p. 277; *Jojutla*, Gadow, 1906, p. 277, F.M.N.H.; *Puente de Ixtla*, Gadow, 1905, p. 195; *West of Puente de Ixtla*, Gadow, 1906, p. 277; *Xochicalco*, M.C.Z.; *Yautepec*, Gadow, 1906, p. 277, F.M.N.H.).

NAYARIT.—(*Acaponeta*, U.S.N.M.; *Isabel Island*, Stejneger, 1899, p. 68, U.S.N.M., C.A.S.; *Ixtlan*, Gadow, 1906, p. 277; *La Barrete*, A.M.N.H.; *Maria Cleofa Island*, Stejneger, 1899, p. 68, U.S.N.M.; *Maria Madre Island*, Stejneger, 1899, p. 68, U.S.N.M., C.A.S.; *Maria Magdalena Island*, Stejneger, 1899, p. 68, U.S.N.M., C.A.S.; *Rosamorado*, A.M.N.H.; *San Blas*, Van Denburgh, 1897, p. 463, U.S.N.M.; *Tepic*, Van Denburgh, 1897, p. 463; *W. Santiago Ixcuintla*, A.M.N.H.).

NUEVO LEON.—(*Linares*, U.S.N.M., F.M.N.H.; *Montemorelos*, Gadow, 1906, p. 332, F.M.N.H.; *Monterey*, Yarrow, 1882, p. 43, U.S.N.M.; *Pesquieria Grande*, Cope, 1900, p. 591, U.S.N.M.; *San Juan*, F.M.N.H.).

OAXACA.—(*Chirela*, M.C.Z.; *Cuicatlan*, Gadow, 1906, p. 352, U.S.N.M., F.M.N.H.; *Laguanas*, Gadow, 1906, p. 352, F.M.N.H.; *Miohuatlan to Ejutla*, A.M.N.H.; *Miohautlan Valley*, A.M.N.H.; *Oaxaca*, Bocourt, 1874, p. 281, A.M.N.H.; *Oaxaca Valley at Oaxaca*, U.S.N.M.; *San Pablo Mitla*, A.M.N.H.; *Santo Domingo de Guzman, isthmus*, Gadow, 1906, p. 118; *Mts. near Santo Domingo*, U.S.N.M.; *Tlacolula*, A.M.N.H.; *Totolapan*, Gadow, 1906, p. 360.)

PUEBLA.—(*Atlixio*, U.S.N.M.; *Chalula to Pyramid*, A.M.N.H.; *Chiantla*, Ferrari-Perez, 1886, p. 196; *Piaxtla*, U.S.N.M.; *Puebla*, Gadow, 1906, p. 277, F.M.N.H.; *San Martin*, U.S.N.M.; *Between San Sebastion and Venta Salada*, A.M.N.H.; *Santa Catarina*, A.M.N.H.; *Tehuacon*, U.S.N.M.; *Tlapanala*, Ferrari-Perez, 1886, p. 195; *Venta Salada*, A.M.N.H.).

QUERETARO.—(*Japlan*, U.S.N.M.; *San Juan del Rio*, Gadow, 1906, p. 277, F.M.N.H.).

QUINTANA ROO.—(*Cozumel Island*, Boulenger, 1887, p. 505).

SAN LUIS POTOSI.—(*Jesus Maria*, U.S.N.M.; *La Parada*, U.S.N.M.; *Morales*, M.C.Z.; *San Luis Potosi*, Garman, 1887, p. 11, U.S.N.M., M.C.Z.; *Soledad*, M.C.Z.).

SINALOA.—(*Mazatlan*, Stejneger, 1899, p. 463, U.S.N.M.; *North of Mazatlan*, A.M.N.H.; *Plomosas*, U.S.N.M.; *Presidio*, Boulenger, 1885, p. 366; *Rincon de Urias*, A.M.N.H.; *Rosario*, U.S.N.M.).

TAMAULIPAS.—(*Bagdad*, U.S.N.M.; *Garza Valdez*, Gadow, 1906, p. 332, F.M.N.H.; *Hidalgo*, U.S.N.M.; *Jaumare Valley*, U.S.N.M.; *Matamoras*, Cope, 1885*b*, p. 380, U.S.N.M., Mich.; *Mier*, U.S.N.M.; *Miquihuana*, M.C.Z.).

VERA CRUZ.—(*Cordoba*, Cope, 1877, p. 95; *Cuatotolapam*, Mich.; *Maltrata*, U.S.N.M.; *Panuco*, M.C.Z.).

YUCATAN.—(*Chichen Itza*, U.S.N.M., M.C.Z.; *Progreso*, M.C.Z.; *Tunkas*, Ives, 1891, p. 459).

ZACATECAS.—(*Berriozabal*, U.S.N.M.; *San Juan Capistrano*, U.S.N.M.).

In Guatemala, the range of this form is very imperfectly known, but it is probably much more extensive than the following reports show. The records follow alphabetically by departments.

ALTA VERAPAZ.—(*Coban*, Cope, 1877, p. 95).

BAJA VERAPAZ.—(*Salama*, Bocourt, 1874, p. 281).

GUATEMALA.—(*Guatemala*, C.A.S.).

JALAPA.—(*El Progreso*, C.A.S.: *El Rancho*, U.S.N.M., F.M.N.H.).

Habitat.—Surprisingly little is known about the hibitat of this form, particularly in the United States. In Burnet County, Tex., *gularis* is as common in the hills as it is along the streams and in the lowlands, according to Strecker (1909*a*, p. 4), and "along the rocky roadsides it is usually found in company with *Crotaphytus collaris* and *Holbrookia texana*." The writer's field acquaintance with the spotted lizard is entirely confined to Texas specimens. Near Lorena, an individual was found among the green vegetation at the side of a small pool of water in a stream bed. In San Saba, Reagan, and Upton Counties, specimens were secured in semi-rocky, scarcely sandy places where considerable shrubbery and some bunch grass were present. The similarity of this habitat with that occupied by the western *perplexus* is striking.

In Reeves County, Tex., at a point north of the Barillo Mountains and about 15 miles east of Balmorhea, *gularis* was found in an environment similar to the one just described in company with *perplexus*, with which it intergrades, and with *Phrynosoma modestum*, *Holbrookia texana*, and *Cnemidophorus tessellatus tessellatus*.

In Mexico *gularis* probably occupies an interesting variety of habitats, due to its plasticity. Specimens were found at the foot of Iron Mountain near Durango on rather barren ground by Gadow (1906, p. 339), who has written several additional notes concerning Mexican specimens. In the district near Ixtlan the spotted race-runner was found near the River Santiago at altitudes varying from 1,500 to 3,500 feet. This district is sandy, rather tropical, and produces much vegetation (p. 341). In the Sierra de Nayarit of Jalisco five specimens were collected at Ranchos in the walls of corrals at 4,600 feet, in open, treeless surroundings (p. 342) and nine were taken near the town of Puebla, Puebla, on railway embankments. Sixteen specimens, collected a few miles west of the town of Oaxaca, were on open, rather barren terrain, or on the slopes of stony ravines with scanty shrubs (p. 360), and northwest of Oaxaca others were taken in shady gardens between stockades and cactus hedges. (Gadow, 1908, p. 270.)

The Tres Marias and Isabel Islands, lying off the west coast of Nayarit, were visited by Slevin (1926, p. 199), who wrote as follows: "This species was found to be very abundant on the beach of Isabel Island" * * * and it was also "a very abundant form about the lower levels of Maria Madre Island, where it was found along the roads, trails, and in brush thickets."

Habits.—The young and adults of *gularis* have different habits, according to Gadow (1903, p. 123), who wrote that these lizards "frequent open ground where the vegetation is scarcely enough to impede their running about. A small lizard can not run as fast as a large one, which darts and bounds away like an arrow. The young remain in the open when disturbed, after running for a few yards, hide in their holes, or under stones, or if the worst comes to the worst, they hide between a few blades of grass which, with its strongly contrasting light and shades, conceals them sufficiently. The larger specimens dash away at a furious pace, and make for the nearest hedge, shrub or bush, which may be 50 yards off; there they abide, not squatting, but in a semierect position with their eyes upon the enemy, under the crisscross shadows, on the reddish-gray ground and dry leaves."

The spotted race runner is one of the swiftest of Texas lizards, according to Strecker (1928, p. 4). It is very difficult to capture, but "if one is willing to be patient and employ strategy, and not attempt to cover too much territory in a short time, he can obtain a good series without shooting them." Two miles south of Lorena, in McLennan County, a specimen darted into some green vegetation at the side of a small pool when disturbed by the writer, and when pursued attempted to hide at the bottom of the pool itself. In Reagan County individuals were seen foraging in open spaces, but quickly took cover when disturbed. As is characteristic of other *Cnemidophori*, their foraging movement was uneven or jerky.

"Hundreds of specimens were observed feeding" on the beach of Isabel Island, as reported by Slevin (1926, p. 199), who found them eating the many "insects gathered about an immense pile of dead sharks left on the sand by Mexican fishermen." Strecker (1928, p. 4) wrote that "It is interesting to observe their feeding habits. They will crawl among and under dead leaves, minutely inspecting every fold or inaequality in them in their search for ants and other small insects. Large males have been known to attack small specimens of other species of lizards and one was found with some very young specimens of *Holbrookia texana* in its stomach." A description of an individual digging in the sand for May beetles was appended to this account, and it was also stated that in some localities *gularis* subsists chiefly on grasshoppers.

There is need for information pertaining to the life history of this lizard. Strecker (1908*a*, p. 168) found that "the females usually scoop out a shallow hollow in the sand and deposit their eggs to a depth of only an inch or two, but on the grassy flats, where there is no sand, eggs have been found buried in the soft earth at the foot of a mesquite tree, to a depth of 4 or 5 inches. The eggs of this species are from 8 to 12 in number."

Enemies.—The prairie racer, *Masticophis flagellum flavigularis*, has been listed by Strecker (1927, p. 10) as preying upon the spotted race runner.

Affinities.—For reasons to be presented in the general discussion at the end of this work (pp. 251–260), *gularis*, the prototype of the *sexlineatus* group, is thought to have been directly derived from a common ancestral stock with the *deppi* and *tessellatus* groups, probably in southern Mexico. Its closest modern relatives are not these, but *sexlineatus* and *perplexus*.

The intergradation between *gularis* and *sexlineatus* is unusually extensive and takes place in southeastern and southern Oklahoma and in much of Texas—from the panhandle southeast to the mouth of the Rio Grande. Part of these intergrades show the blue ventral suffusion and the enlarged postantebrachials of *gularis*, while the rest show the ventral whiteness and the granular postantebrachials of *sexlineatus*. These major variations occur independently of each other and in all manner of combinations. Intergradation also occurs in spotting and in the maximum size of individuals.

Brown (1903, p. 548) wrote that "while *sexlineatus* and *gularis* have doubtless had a common origin, the differentiation reached in the adults is great, and the occasional retention of the earlier style of color marking by the young of *gularis* can not be regarded as true intergradation." Under this supposition, it would be inferred that *gularis* has been derived from *sexlineatus*, but for reasons to be presented later, this does not seem to be the case. Many specimens from the Mexican mainland differ from *sexlineatus* only in the presence of enlarged postantebrachials, others only in the presence of a bluish ventral suffusion, and still others only in the presence of spots in the lateral fields. Fortunately, perhaps, all Mexican specimens examined by the writer have been found to differ from *sexlineatus* in one of these ways, but these variations or combiantions suggest *sexlineatus* long before its actual evolution in the United States. The significant thing about the intergradation in Texas is not that the young of the two forms are often alike but that there is an extensive overlapping or confusion in the structural and colorational features of the *adults* as well.

The intergradation between *gularis* and *perplexus* is apparently not as extensive as that between *gularis* and *sexlineatus*, although the line of contact between the two forms is fully as long, extending from the panhandle of Texas southward to Coahuila and west to the Gulf of California. This difference may be attributed to the relatively poor delineation of contrasting habitat conditions at the line of contact between *gularis* and *sexlineatus*.

Gularis is largely intermediate between *sexlineatus* and *perplexus*, differing from *sexlineatus* in the same way as *perplexus* differs from *sexlineatus* (by the much larger maximum size, frequent appearance of spots or crossbars on the sides, and the usual presence of enlarged scutes or polygones on the posterior surface of the forearm), and differing from *perplexus* in the same way that *sexlineatus* differs from *perplexus* (by the presence of a widened, yellowish, middorsal streak and a wider dorsal field). Yet, in addition, *gularis* differs from both in the presence of a bluish ventral suffusion which offers an approach to the southern *deppii* group with which it was presumably linked at one time through a common ancestral population. This is held to support the theory of the derivation of *sexlineatus* and *perplexus* from a central *gularis* stock rather than the derivation of *gularis* from one of these, particularly from *sexlineatus*. At the line of intergradation between *gularis* and *perplexus* the bluish ventral suffusion and the yellowish middorsal streak of *gularis* is lost and leaves the uniform ground color, above and below, which is so characteristic of *perplexus*. Here also the lines are modified, the third pair from the bottom on each side migrating toward the center of the back to produce a predominately 6-lined form which has a narrow middorsal interspace, or a 7-lined form with a distinct, instead of a diffuse, middorsal stripe—such as the modern *perplexus*. While *perplexus* is merely a color variety of *gularis*, it is distinct outside of the area of intergradation, and as such presents a fundamental evolutionary divergence from *gularis*.

Recently, Strecker (1929*a*, p. 6) has written, while admitting that color characteristics are often misleading, that "the same observation might be made for the number of scale rows and femoral pores. If *sexlineatus* and *gularis* are varieties of the same species, there is in this section of Texas (Wilbarger County) a marked difference between them in size, life coloration, and to a lesser degree, in their habits and environments." It may be remarked here that Strecker's observations on color characteristics and the number of femoral pores are in exact accordance with those of the writer. Also, the number of longitudinal ventral scale rows is eight in most species of *Cnemidophorus*, and in addition the number of ventral rows and the number of dorsal rows are not used in classification here. Several detailed accounts of local differences between *sexlineatus* and *gularis*, or between *gularis* and *perplexus* as well, in regions where they occur together as presumably distinct and nonintergrading units are much to be desired. The writer believes that such accounts will call attention to "local phases," to change in habitat due to age, to a definite response to the influence of environments, and, very likely, even to confusing intergradation itself.

CNEMIDOPHORUS SEXLINEATUS PERPLEXUS (Baird and Girard)

SONORAN RACE RUNNER

1852. *Cnemidophorus perplexus* BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., p. 128 (type locality, "Valley of the Rio Grande del Norte," western Texas; type specimen,[16] U.S.N.M. No. 3060; collected by Dr. William Gambel on his last journey to California); Reptiles, in "Expl. Red River of La." (1852), 1853, p. 239.—HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1854, p. 94; Pacific R. R. Surv. (Williamson Route), vol. 10, pt. 4, no. 1, 1859, p. 8.—BAIRD, Reptiles of the Boundary, U. S.-Mex. Boundary Surv., 1859, p. 10.—COPE, Bull. U. S. Nat. Mus., vol. 1, 1875, p. 46.—COUES, Synops. Reptiles and Batr. Ariz., Geog. Geol. Expl. Surv. w. 100th Mer., vol. 5, chap. 5, 1875, p. 603.—YARROW, Bull. U. S. Nat. Mus., vol. 24, 1882, p. 44.—GARMAN, Bull. Essex Inst., vol. 16, 1884, p. 13.—BOULENGER, Cat. Liz. British Mus., vol. 2, 1885, p. 360.—BAILEY, N. Amer. Fauna, vol. 25, 1905, p. 44.—GADOW, Proc. Zool. Soc. London, 1906, p. 368.—STRECKER, Baylor Univ. Bull., vol. 12, 1909, p. 14; vol. 18, 1915, p. 24.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., 1917, p. 67.—BRADLEY, Sci. Monthly, vol. 8, 1919, p. 414.—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 495.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 72.—PRATT, Manual Vert. Animals U. S., 1923, p. 205.—VAN DENBURGH, Proc. Calif. Acad. Sci., ser. 4, vol. 13, 1924, p. 211.—STRECKER, Contr. Baylor Univ. Mus., vol. 16, 1928, p. 13.

1853. *Cnemidophorus gularis* (part) HALLOWELL, Reptiles, in Sitgreave's "Rept. of an Exp. down the Zuni and Colo. Rivers," p. 145.—COPE, Amer. Nat., vol. 25, 1891, pp. 1135–1136; Amer. Nat. vol. 26, 1892, p. 522.—STONE and REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 32.—BAILEY, N. Amer. Fauna, vol. 25, 1905, p. 44.—DITMARS, Reptile Book, 1907, p. 187.—STEJNEGER and BARBOUR, Check List. N. A. Amph. and Rept., 1917, p. 67; ed. 2, 1923, p. 71.—PRATT, Manual Vert. Animals U. S., 1923, p. 204.

1858. *Cnemidophorus octolineatus* BAIRD, Proc. Acad. Nat. Sci. Phila., p. 255, (type locality, Pesquieria Grande, "New Leon," Mexico; type specimen, U.S.N.M. No. 3009, Lt. Couch, collector); Reptiles of the Boundary, U. S.-Mex. Boundary Surv., 1859, p. 10.—COPE, Bull. U. S. Nat. Mus., vol. 1, 1875, p. 45; Proc. Amer. Philos. Soc., vol. 17, 1877, p. 95.—YARROW, Bull. U. S. Nat. Mus., vol. 24, 1882, p. 188.—GARMAN, Bull. Essex Inst., vol. 16, 1884, p. 13.—COPE, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 45; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 40; Amer. Nat., vol. 30, 1896, p. 1014; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 589.—GADOW, Proc. Zool. Soc. London, 1906, p. 373.

1859. *Cnemidophorus gularis* HALLOWELL, Pacific R. R. Surv. (Parke Route), vol. 10, pt. 6, sect. 2, p. 23.—VAN DENBURGH, Proc. Calif. Acad. Sci., ser. 2, vol. 6, 1896, p. 342; Proc. Acad. Nat. Sci. Phila., 1897, p. 463.—STEJNEGER, Proc. U. S. Nat. Mus., vol. 25, 1902, p. 151.—RUTHVEN, Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, p. 556.—STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 230.—CARY, N. Amer. Fauna, vol. 33, 1911, pp. 21, 27, 40.—VAN DENBURGH, and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 3, 1913, p. 407.—BAILEY, N. Amer. Fauna, vol. 35, 1913, p. 20.—ELLIS and HENDERSON, Univ. Colo. Studies, vol. 10, 1913, p. 78.—BRADLEY, Sci. Mo., vol. 8, 1919, p. 420.—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 499; Proc. Calif. Acad. Sci., ser. 4, vol. 13, 1924, p. 212.—COCKERELL, Zool. of Colo., Univ. Colo. Semicentennial Ser., vol. 3, p. 106.—Ortenburger, Mem. Univ. Mich. Museums, vol. 1, 1928, p. 53.—Tanner, Copeia, no. 166, 1928, p. 27.—Woodbury, Copeia, no. 166, 1928, p. 18.

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[16] The type is in only fair condition. The tail is completely broken 43 mm. from the base. An injury at the left side of the base of the tail has been covered by a conspicuous regeneration of small scales.

1866. *Cnemidophorus 6-lineatus* Cope, Proc. Acad. Nat. Sci. Phila., p. 311.

1866. *Cnemidophorus sexlineatus gularis* (part) Cope, Proc. Acad. Nat. Sci. Phila., p. 303.—Bocourt, Miss. sci. Mex. et Amer. cent., vol. 3, 1874, p. 278.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 597.

1875. *Cnemidophorus sexlineatus* Coues, Synops. Rept. and Batr. Ariz., Geog. Geol. Expl. Surv. w. 100th Mer., vol. 5, chap. 5, 1875, p. 620.—Cope, Proc. Acad. Nat. Sci. Phila., 1883, pp. 11–12.—Herrick, Terry, and Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, 1899, pp. 146, 148.—Ruthven, Bull. Amer. Mus. Nat. Hist., vol. 23, 1907, p. 570.—Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 230.—Bailey, N. Amer. Fauna, vol. 35, 1913, p. 20.—Ellis and Henderson, Univ. Colo. Studies, vol. 11, 1915, p. 260.—Ruthven, Geogr. Rev., vol. 10, 1920, p. 243.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 4, vol. 13, 1924, p. 212.

1875. *Cnemidophorus sexlineatus* (part) Cope, Bull. U. S. Nat. Mus., vol. 1, p. 45.—Yarrow, vol. 24, 1882, pp. 8, 43–44.—Palacký, Zool. Jahrb. (abt. syst., geog. u. biol.), vol. 12, 1899, pp. 253, 282.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 593.—Gadow, Proc. Zool. Soc. London, 1905, p. 216; 1906, p. 302.—Ellis and Henderson, Univ. Colo. Studies, vol. 10, 1913, p. 78.—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 67; ed. 2, 1923, p. 73.—Pratt, Manual Vert. Animals U. S., 1923, p. 204.—Cockerell, Zool. of Colo., Univ. Colo. Semicentennial Ser., vol. 3, 1927, p. 106.

1875. *Cnemidophorus sex-lineatus* Yarrow, Geog. Geol. Surv. w. 100th Mer., vol. 5, chap. 4, p. 557.

1875. *Cnemidophorus sexlineatus gularis* Coues, Geog. Geol. Surv. w. 100th Mer., vol. 5, chap. 5, p. 602.—McLain, Critical Notes on a Coll. of Rept. from the West. Coast of U. S., printed privately, 1899, p. 9.

1875. *Cnemidophorus octo-lineatus* Yarrow, Geog. Geol. Expl. Surv. w. 100th Mer., vol. 5, chap. 4, p. 558.

1884. *Lacerta 6-lineata* (part) Garman, Bull. Essex Inst., vol. 16, p. 12.

1885. *Cnemidophorus sex-lineatus* (part) Gunther, Rept. and Batr. in "Biol. Cent.-Amer.," p. 25.

1886. *Cnemidophorus sexlineatus sexlineatus* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *gularis*).

1886. *Cnemidophorus sexlineatus, subspecies no. 3.* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283, (intergrades with *gularis*).

1886. *Cnemidophorus sexlineatus, subspecies no. 4.* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283, (intergrades with *gularis*.)

1886. *Cnemidophorus sexlineatus, subspecies no. 5.* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283, (intergrades with *gularis*).

1886. *Cnemidophorus sexlineatus tigris* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (type locality, "City of Chihuahua", Chihuahua, Mexico) (intergrades with *gularis*).

1886. *Cnemidophorus sexlineatus guttatus* Cope, Proc. Amer. Philos. Soc., vol. 23, p. 283 (intergrades with *gularis*).

1891. *Cnemidophorus gularis scalaris* (intergrades with *gularis*) Cope, Amer. Nat., vol. 25, p. 1135 (*nomen nudum*); Trans. Amer. Philos. Soc., vol. 17, 1892, p. 47 (type locality, "Mexican Plateau south of Chihuahua" and "City of Chihuahua," Chihuahua, Mexico; 5 cotypes, U.S.N.M. No. 8319, and 2 cotypes, U.S.N.M. No. 14302, John Potts, collector); Proc. Acad. Nat. Sci. Phila., 1892, p. 335.—Boulenger, Zool. Rec. for 1892, vol. 29, "Reptilia," 1893, p. 23.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 605.

1892. *Cnemidophorus tessellatus perplexus* Cope, Amer. Nat., vol. 26, p. 522; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 34; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 573.

1892. *Cnemidophorus septemvittatus* Cope, Trans. Amer. Philos. Soc., vol. 17, p. 40 (type locality, "Eldorado County, California," but probably western Texas; type specimen, U.S.N.M. No. 42141, collector unknown).—Boulenger, Zool. Rec. for 1892, vol. 29, "Reptillia," 1893, p. 23.—Cope, Amer. Nat., vol. 30, 1896, p. 1019; Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 591.—Gadow, Proc. Zool Soc. London, 1906, p. 335.—Wright and Funkhouser, Proc. Acad. Nat. Sci. Phila., 1915, p. 132.

1892. *Cnemidophorus gularis gularis verus* (intergrades with *gularis*) Cope, Trans. Amer. Philos, Soc., vol. 17. p. 45 (type locality, "City of Chihuahua," Chihuahua, Mexico); Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 604.

1892. *Cnemidophorus gularis gularis obsoletus* (intergrades with *gularis*) Cope, Trans, Amer. Philos. Soc., vol. 17, p. 45, (type locality, "City of Chihuahua," Chihuahua, Mexico); Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 604.

1892. *Cnemidophorus gularis gularis* (part) Cope, Trans. Amer. Philos. Soc., vol. 17, p. 45; Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 602.—Gadow, Proc. Zool. Soc. London, 1906, p. 331.

1896. *Cnemidophorus scalaris* Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 6, p. 343.

1896. *Cnemidophorus arizonae* Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol 6, p. 344 (type locality, "Fairbank, Cochise County, Arizona"; type specimen, Stanford No. 2631, W. W. Price, collector).—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 65.

1899. *Cnemidophorus sexiticatus* Herrick, Terry, and Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, p. 145.

1899. *Cnemidophorus sexilicatus* Herrick, Terry, and Herrick, Bull. Sci. Lab. Denison Univ., vol. 11, p. 148, pl. xxiv.

1900. *Cnemidophorus gularis scalaris* Cope, Ann. Rep. U. S. Nat. Mus. for 1898, p. 605 (part).

1903. *Cnemidophorus sexlineatus perplexus* Brown, Proc. Acad. Nat. Sci. Phila., p. 547.—Burt and Burt, Jour. Wash. Acad. Sci., vol. 19, 1929, p. 450.

1906. *Cnemidophorus scalaris* Gadow, Proc. Zool. Soc. London, p. 335 (intergrades with *gularis*).

1906. *Cnemidophorus communis occidentalis* (part) Gadow, Proc. Zool. Soc. London, p. 339 (type localities numerous and listed below in connection with the data pertaining to the cotypes, northern Mexico; 1 cotype, "Lake Santa Maria, northwest Chihuahua," F.M.N.H. No. 2534; 2 cotypes, "Lerdo," F.M.N.H. No. 1401; 4 cotypes, "Durango," F.M.N.H. No. 1284; 2 cotypes "Durango," B.M.N.H. 1906.7.19.9–10; 11 cotypes, "Ixtlan," B.M.N.H. 1892.2.8.33–43; 5 cotypes, "Sierra de Nayarit," B.M.N.H. 1892.2.8.44–48; 6 cotypes, "Presidio," B.M.N.H. 1883.4.5.22–27; 2 cotypes, "Zapotlan," F.M.N.H. No. 2535; 8 cotypes, "Puebla," F.M.N.H. Nos. 1321–1322; 5 cotypes, "Puebla," B.M.N.H. 1906.7.19.18–22; 2 cotypes, "Patzcuaro," F.M.N.H. Nos. 1024–1025; 5 cotypes, "Acambaro," F.M.N.H. Nos. 1018–1019; 3 cotypes, "San Juan del Rio," F.M.N.H. No. 1027; 6 cotypes, "Guanajuato," B.M.N.H. 1898.7.19.2–7).

1919. *Cnemidophorus gularis* Bradley, Sci. Monthly, vol. 8, p. 419.

1926. *Cnemidophorus gularis gularis* Ortenburger and Ortenburger, Proc. Okla. Acad. Sci., vol. 6, p. 110.—Springer, Copeia, no. 169, 1928, p. 104.

1928. *Cnemidophorus gularis velox* Springer, Copeia, no. 169, 1928, p. 102 (type locality, "Sandy deserts south of the Colorado River from Lee's Ferry, Ariz., to Pueblo Bonito, N. Mex."; type specimen, Butler Univ. no. 848).

Systematic Notes.—This form was described in 1852 by Baird and Girard, who separated it from the distantly related entities, *tigris*, *marmoratus*, and *grahamii* (all of which are now considered synonymous with *tessellatus*) on relatively insignificant characters. After an examination of the type, it is not clear why these authors should have written that this lizard has the "general appearance of *grahamii*," for spots and reticulations are absent from its pattern. However, the ground color is "yellowish green" and there are "seven yellowish stripes extending from the occiput to the base of the tail." It is the presence of these stripes and the absence of field spots that have served as the basis of its recognition until the present time. The writer has found that both of these characters are insufficient. There is a complete transition from the unspotted to the spotted phase; and the number of lines on the body varies from six to eight, commonly being six and a fraction. Thus, it is found that the hitherto recognized "*gularis*" of the Sonoran region is identical with *perplexus* and that this whole population possesses characteristics which make it a taxonomic entity, sufficiently separating it from the closely related eastern and southern relatives, which are *sexlineatus* and the true *gularis*. Because of intergradation with these forms, chiefly in western Texas, *perplexus* is here given subspecific rank. Thus, the *C. sexlineatus perplexus* of this work is the representative of the *sexlineatus* group in the Sonoran region of the United States and Mexico.

By the examination of specimens at the United States National Museum, it is found that the numerous forms of *Cnemidophorus* described by Cope from southern Chihuahua are in reality intergrades between *gularis* and *perplexus*, and as such they are given places in the synonymy of both subspecies. The detailed discussion of these is given under *gularis* (see p. 104).

During the period of development *perplexus*, like *gularis*, goes through an intricate series of pattern stages, and while there is considerable individual variation, the evolution is in all cases essentially the same. The young are often unspotted, and in such, as a rule, the appearance of spots in the lateral fields may be expected sooner or later. In certain individuals and regions this phenomenon seems to be retarded more than in others. At times the spotted phase is transformed into a tiger-barred phase by the spreading of the spots to form cross-bars with the stripes above and below them. This is accompanied by a tendency for the dark ground color to also encroach upon the longitudinal light stripes and to unite across them. Thus the whole aspect of the pattern is changed, the emphasis being transferred from the longitudinal to the transverse. When series are examined it becomes impossible to separate one phase from another,

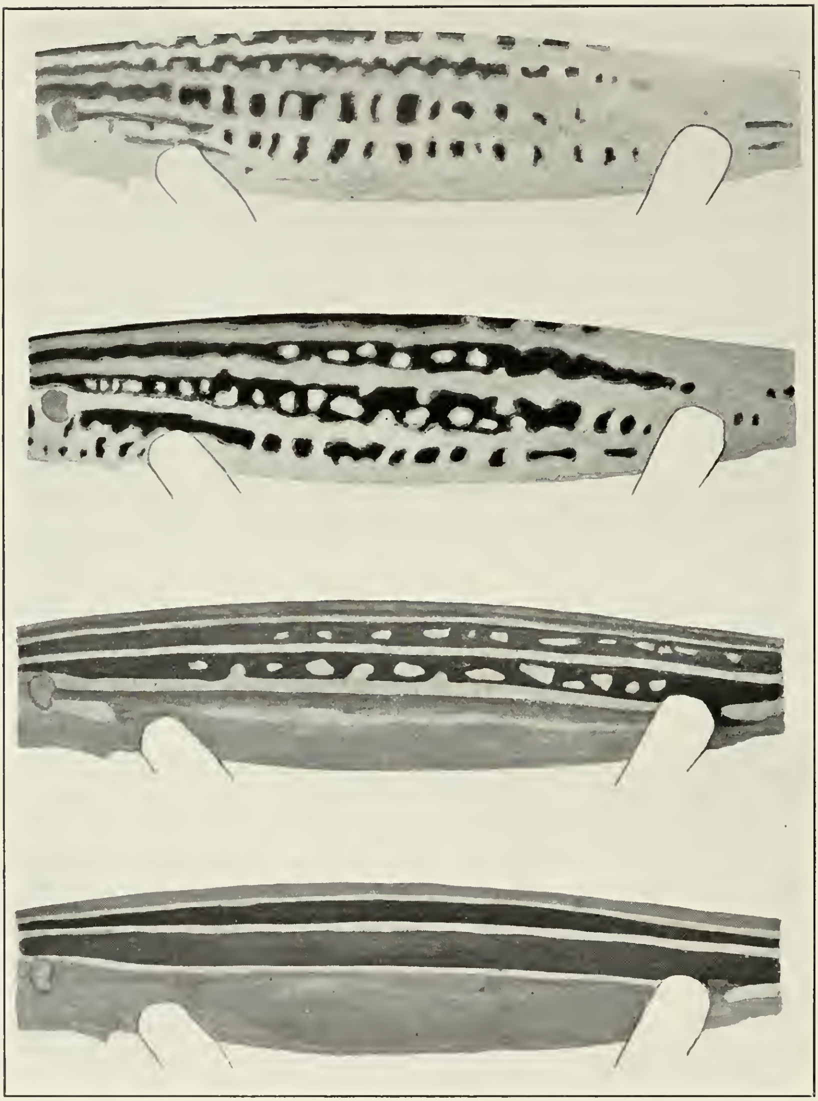

FIGURE 22.—CNEMIDOPHORUS SEXLINEATUS PERPLEXUS. ONTOGENETIC VARIATION IN THE COLOR PATTERN. NOTE THE METHOD OF TRANSITION FROM THE STRIPED TO THE CROSS-BARRED OR TESSELLATED CONDITION. THE END RESULT OF THIS TYPE OF COLOR EVOLUTION IS A UNICOLORED LIZARD—A PHASE ACTUALLY REACHED IN THE CLOSELY RELATED SUBSPECIES, C. SEXLINEATUS GULARIS

and it becomes apparent that the presence or absence of either lines or spots can not be used as a diagnostic character.

As might be expected, the phases and variations of *perplexus* have been given a series of taxonomic designations. The striped, unspotted forms are as follows: *sexlineatus* (6-striped), *velox* (6 to 7 striped), *perplexus* (7-striped), *arizonae* (7-striped), and *octolineatus* (8-striped). The striped, spotted forms are *gularis* of the Sonoran region and the *perplexus* of Gadow (1906). A transition to the cross-barred phase is shown in *septemvittatus*, and the end phase itself has been called *scalaris*. The nature and value of these designations will be discussed here in the order given.

The 6-lined, unspotted, examples have often been called *sexlineatus* because of their appearance. They differ in several respects from that subspecies, however, as shown below in the diagnosis. The writer is unable to recognize *Cnemidophorus gularis velox*, described from northern Arizona by Springer (1928, p. 102). It is stated in the description that there are "seven stripes, central faint," so the types may be regarded as intergrades between the 6 and 7 lined individuals of *perplexus*. If more specimens had been examined, it would be expected that the middorsal or seventh stripe would have been found to be absent in part of them, and present anteriorly as a vestige in others.[17]

As indicated above, *perplexus*, as hitherto, recognized, is the 7-striped phase of this lizard. One of these individuals served as the type of *C. arizonae* Van Denburgh (1896*b*, p. 344), who found that it had the "anterior nasal in contact with the second upper labial." This character was used by Stejneger (1890) in the diagnosis of *labialis* from Cerros Island and it is no doubt this systematic emphasis that caused Van Denburgh to look for it in *perplexus*. In 1913, Van Denburgh and Slevin (p. 408), after the examination of additional specimens from the types locality, Fairbank, Ariz., wrote that "While none of these has the nasal in contact with the second labial, this relation is found on one side of the head in a specimen with the coloration usually seen in the young of *gularis* (= spotted *perplexus*). It may be, therefore, that *arizonae* is based on an abnormal individual of *gularis*, which differs from the usual type in coloration, in the arrangement of the nasal and second labial plates, in the number of femoral pores, and in the size of the postantebrachial plates." Although here admitting the weakness of *arizonae*, Van Denburgh did not synonymize it with *perplexus* until 1922 (p. 495), at which time he wrote as follows: "I recently secured from El Paso, Tex., two specimens of *perplexus*. One of these specimens has the anterior nasal in contact with the second labial. As both specimens seem to agree with *arizonae* in all other respects, this name may now be regarded as a synonym of *perplexus*."

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[17] A recent examination of the type (Butler Univ. No. 848) actually reveals the latter condition, the vestige of a middorsal stripe being present only anteriorly.

The 8-lined phase was described as *octolineatus* by Baird (1858, p. 255) from a specimen from Nuevo Leon, Mexico. Since it was collected by Lieutenant Couch and the exact locality is unknown, it may have possibly been collected still farther west. It is known that he visited Coahuila, too. The original description is only a few lines long and is largely indefinite. However, it was stated that the back was "with eight equidistant and approximated light lines." An examination of the type shows that it has no spots in the fields and that its only peculiarity is the possession of eight lines. Yarrow (1875, p. 558) reported *octolineatus* from New Mexico and Van Denburgh (1924, p. 211) synonymized this record with *perplexus*. On the other hand, Günther (1885) made *octolineatus* a synonym of *deppii*. The presence of four supraoculars and the general appearance do not support the latter view, and the finding of an additional 8-lined specimen in western Texas (U.S.N.M. No. 33072), where both 6 and 7 lined examples frequently occur, furnishes another bit of negative evidence. After the consideration of the obvious similarity of *octolineatus* to *perplexus*, the discontinuous geographical range of the known specimens, and the remarkable variation found in the dorsal striping of *perplexus*, the two forms are here regarded as synonymous.

The usual spotted form of *perplexus* has been hitherto identified as "*gularis*" without reference to the number of lines. As already stated, complete transition from the unspotted to the spotted phase occurs in many localities, so the recognition of a systematic diagnosis based on these variations is impossible. In the region of Albuquerque, N. Mex., some of the specimens are 7-lined and have only a few spots. These spots are rather obscure and appear only in the lower field just anterior to the insertion of the hind leg. Another peculiarity lies in the fact that the dorsal stripes are usually more or less wavy. However, individuals identical to these are found in other populations, so it seems illogical to consider this type of variant as a distinct taxonomic unit. Examples of *perplexus* from Albuquerque were seen by Gadow (1906), who described no other phase.

In 1892 Cope described *septemvittatus* from "Eldorado County, California" as a species having "seven longitudinal broad black bands on the dorsal surface." It was shown by Van Denburgh (1897, p. 133) that the species was probably not an inhabitant of California, and Gadow (1906, p. 133) wrote that "to judge from this solitary specimen, it seems to belong rather to the *communis* of the *gularis* group." Since specimens of the *gularis* group (of Gadow) do not occur in California, and because of Van Denburgh's statement, *septemvittatus* has of late been "deprived" of locality. Wright and Funkhouser (1915, p. 132) wrote that "it might be noted that in many of the specimens reported from the Okefinokee the plate arrangement agrees much more nearly with the description and figure of *septemvittatus* than with *sexlineatus*. * * * In fact, if the median dorsal longitudinal line which sometimes appears were more distinct, some of these specimens would seem to merge into typical *septemvittatus*." Contrary to this suggestion, an examination of the type shows that it is typical *perplexus*, for the specimen is partly lined, partly spotted, and partly cross-barred. The field spots are irregularly placed and appear to be spreading or becoming dominant over much of the ground color to produce a more or less definite "*scalaris*" type of coloration. Because of a peculiar intensification of the ground color to a deep black, the color pattern of the type of *septemvittatus* is rather distinctive. A comparison of the type with a specimen from Marfa, Tex. (U.S.N.M. No. 33073), showed the two to be identical in coloration and in other respects, and subsequently the Marfa specimen has been compared with a large series of specimens from Brewster County, Tex. (Mich.), and these have also been found to represent the darker phase of *perplexus*. Therefore, the type of *septemvittatus* may be assumed to have come from this general locality. All of these specimens are alike in having enlarged postantebrachials, so that there is little need to confuse them with *tessellatus*, which, in the higher levels, sometimes has a very similar general appearance, but fortunately, has only granules on the posterior surface of the forearm. The absence of a dark ventral suffusion and of a yellowish middorsal streak alters *septemvittatus* to *perplexus* rather than to *gularis*, and the appearance of typical 6 to 7 lined young in the same habitat (Brewster County, Tex.), further supports this view. The peculiar dark ground color occurs only in upland specimens as in *tessellatus* (see account of this under that form, pp. 154–157 and 166), and is not wholly constant, so *septemvittatus* is not given recognition here as a distinct entity.

In 1892 Cope described *scalaris* from a series of specimens from Southern Chihuahua which have been found to be intergrades between *gularis* and *perplexus*. These are discussed under *gularis*. *Scalaris* represents the end evolution of the color pattern of both forms and it was logical for Van Denburgh (1896, p. 343) to write as follows about two specimens from Arizona: "These agree very well with the original description. They are much larger than *gularis*, and are possibly, though improbably, very old males of that species." The futility of recognizing the two forms as distinct was originally conceived by Ruthven (1907, p. 557), who wrote that "There is considerable variation in size among the Tucson specimens, so much so, in fact, as to have caused their reference to different species. Stejneger after an examination of specimens in this collection, both from Alamogordo and Tucson, still considers the eastern and western individuals as belonging to a single form (*C. gularis*) as he has always done, but Cope (1900, p. 606) and Van Denburgh (1896, p. 341) have both referred the larger Tucson specimens to *scalaris*, although both record *gularis* from the same region. From our series it is evident that there is but one species at Tucson, and that the specimens referred to typical *gularis* by Van Denburgh and Cope are in reality not full grown specimens. Since individuals of this size are generally indistinguishable from Alamogordo specimens, I have no hesitancy in referring them to the same species. The difference between them lies in the fact that while those at Tucson often reach a total length of 400 mm. and over, I am convinced that Alamogordo specimens seldom exceed 280 mm. The difference I believe may be attributed to differences in the nature of the habitat * * *. In both localities *gularis* is strictly a ground form * * * and it is conceivable that the environmental conditions at Tucson may be more favorable for this species than those composing its habitat at Alamogordo, and thus be directly or indirectly the cause of the larger size attained by individuals in this locality. If this be the true explanation of the facts in the case it must be that the Alamogordo specimens are either inhibited from attaining a larger size by exigencies of their habitat, or represent a dwarfed race." *Scalaris* was definitely synonymized with *gularis* (=*perplexus*) by Van Denburgh and Slevin (1913, p. 408), who wrote that "Our series from Tucson and the steam pump include a number of very large individuals with the coloration typical of the form which has been called *scalaris*. As we also have specimens intermediate in size and coloration, it would appear that *scalaris* is based on very old individuals of *gularis*." The writer has examined all of the specimens mentioned in the above discussions and fully agrees with the conclusions expressed above.

Diagnosis.—The Sonoran race runner is distinguished by its possession of four supraoculars, somewhat enlarged dorsal granules, and a uniform dorsal and lateral ground color. When lined, there are from six to eight stripes present, and the third (usually the upper lateral) pair of stripes on each side are often placed closer to each other than to the stripes below them. A widened, yellowish, middorsal streak is never present. The under surfaces are usually white, although sometimes they stain to blackish in preserved material, but they are never blue or blue-black as in typical specimens of *gularis*. Certain specimens of *perplexus* differ from *sexlineatus* in the presence of enlarged polygones or scutes on the posterior surface of the forearm, in the attainment of a body length of over 85 mm. (snout to anus), in the presence of spots in the lateral fields, or in the presence of cross-bars and reticulations on the sides. Any of these differences from *sexlineatus* are diagnostic, although they do not separate *gularis* from *perplexus*.

Description.—Snout moderately pointed; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars normally 4; supraocular granules usually not extending forward past the anterior border of the fourth supraocular, and rarely extending past the middle of the third; supraocular granules relatively large, usually not over three rows between the posterior supraocular and the external parietal plates; frontoparietals normally 2; parietals normally 3; anterior gulars moderate to large, graded, usually somewhat enlarged centrally; posterior gulars smaller, although sometimes secondarily enlarged just anterior to the first gular fold; mesoptychium with rather large scutes, these uniform or graded and often enlarged centrally, in 1–4 rows; postmesoptychial granules minute, usually hidden by posterior gular fold, seldom on edge of mesoptychium.

Body elongate; ventral plates in 8 longitudinal and 32–40 transverse rows; dorsal granules moderately large; limbs well developed; brachials 4–10; antebrachials 2–4; brachials more or less continuous with antebrachials at a point of contact; posterior side of forearm with granules, polygones or scutes; femorals 5–10; tibials 3–5; femoral pores 14–23; tail elongate, tapering; caudal scales smooth below, keeled above; lateral keels moderately strong to weak, more or less distinctly longitudinal in arrangement, on moderately large plates.

Coloration highly variable; ventral surfaces usually white, but sometimes faded to blackish in preserved specimens; in life, sometimes with light blue or slate at the sides of the chest and abdomen, but never with blue-black as in many specimens of *gularis;* tail usually unspotted below, unicolor or spotted and reticulated above; femora normally unspotted in specimens of the common lined phase, but more or less distinctly spotted in the larger cross-barred phase; back lined or unlined; if lined, size small, six to eight stripes present, middorsal one if present often vestigal or rudimentary; if unlined, size large, vestiges of stripes may or may not be present dorsally, especially anteriorly, but crossbars, reticulations or spots always present; spots present or absent in the lateral fields of the young and in the lines themselves; ground color of back and sides not distinctly contrasted, usually brownish, grayish or black; a yellowish middorsal streak never present as in most specimens of *gularis* and *sexlineatus*.

A total of 1,266 specimens of *perplexus* have been examined and all are found to be remarkably uniform in most proportional and scutellational features. Data from a representative series of 225 specimens are as follows: Body, 29–123 mm.; tail, 54–290; total length, 85–413; length of tail as percentage of total length, 64–76; width of head, 5–20; width of head as percentage of body length, 11.4–16.5; hind leg, 19–77; length of hind leg as percentage of body length, 58–76; frontoparietals two in 224 specimens, and 4 in 1 specimen; supraoculars 4 in 223 specimens, and 4–5 in 3 specimens; supraocular granules not extending forward past the anterior border of the fourth supraocular in 170 specimens, but extending to the middle of the third supraocular in 55 specimens.

Variation.—The dorsal striping is highly variable and data from a series of 109 specimens from distinctive points in the range of *perplexus* are used in the following table to show that there is no geographical consistency in this variation.

Table of variation in the dorsal striping of C. sexlineatus perplexus

No. and condition of stripes	Number of specimens			
	Apache County, Ariz.	Cohise County, Ariz.	Chihuahua	Texas
7 distinct, dorsals straight				1
8 distinct, dorsal straight	4	8	1	24
7 distinct, dorsal wavy			3	
6 distinct, dorsal a chain of spots only	4		2	
6 distinct, long trace of dorsal, or dorsal faint	11	15	4	3
6 distinct, short trace of dorsal	2	5	3	1
6 distinct, no trace of dorsal	9	5	2	2
Totals	30	33	15	31

The specimens selected for the above table were all unspotted young and were conspicuously striped. If the spotted phase had been used the percentage of specimens without a dorsal or seventh stripe would have been greater for apparently this tends to disappear with age.

The two dorsal stripes in a 6-lined specimen from San Pedro Bay, Sonora (C.A.S. No. 53425) are close set anteriorly and united behind to form a broad streak there. The remaining four stripes are normal, and the ventral color is typical. The coloration, therefore, is suggestive of *hyperythrus*.

Some 7-lined specimens from New Mexico have the femur prominently reticulated with white as in an example from Albuquerque (U.S.N.M. No. 45160). The appearance of these variants is probably what caused Cope (1900) to refer to *perplexus* as a subspecies of *tessellatus* which usually has a prominently spotted or reticulated femur.

Range.—This race runner occupies favorable habitats in the Sonoran region of the United States and Mexico. It occurs from west central Utah and western Colorado, southeast to northern Coahuila, thence westward to the Gulf of California and north to west central Utah. Island populations of *perplexus* are unknown.

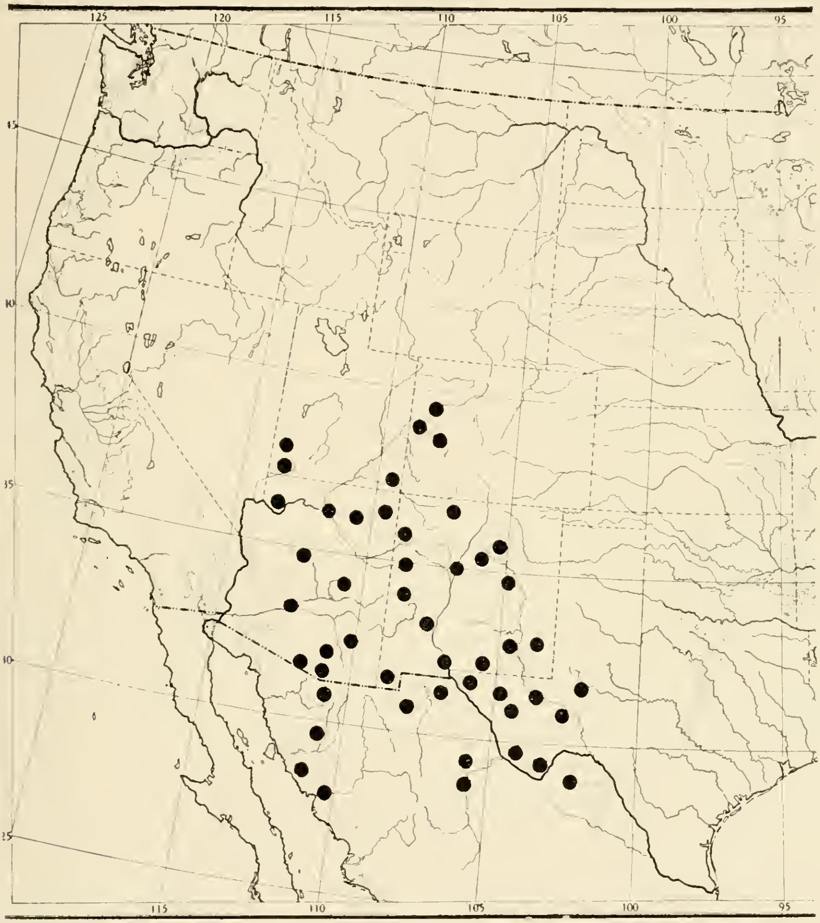

FIGURE 23.—MAP SHOWING THE LOCALITY RECORDS FOR CNEMIDOPHORUS RECORDS FOR CNEMIDOPHORUS SEXLINEATUS PERPLEXUS (COUNTY REPORTS IN THE UNITED STATES)

The records for the United States are presented below by states in alphabetical series.

ARIZONA.—Apache County (*Apache*, M. V. Z. U. C.; Cañon de Chelly, U.S.N.M.: *White Mountains*, Yarrow, 1875, p. 558). Cochise County (*Ash Canyon*, Van Denburgh, 1922, p. 503; *8 miles* *north of Bernardino*, Burt, Mich.; *Bisbee*, Van Denburgh, 1922, p. 503, U.S.N.M., A.M.N.H.; *Brown Canyon*, Van Denburgh, 1922, p. 503; *Camp Bowie*, Yarrow, 1875, p. 558; *Carr Canyon*, Van Denburgh and Slevin, 1913, p. 407, A.N.S.P., Taylor; *Cave Creek in the vicinity of the Chiricahua Mountains*, idem., p. 407, C. A. S.; *Chiricahua Mountains*, Van Denburgh, 1922, p. 503, M.V.Z.U.C., Stanford; *Chiricahua Ranch*, U.S.N.M.; *Dos Cabezas*, M.V.Z.U.C.; *11 miles south of Dos Cabezos*, M.V.Z.U.C.; *9 miles southeast of Dos Cabezos*, M.V.Z.U.C.; *6 miles southwest of Dos Cabezos*, M.V.Z.U.C.; *Douglas*, C.A.S.; *Dragoon Station*, Stone, 1911, p. 230, A.N.S.P.; *Fairbank*, Van Denburgh, 1922, p. 503, Stanford, C.A.S.; *Fort Huachuca*, Stejneger, 1902, p. 151, U.S.N.M.; *Gardner Canyon*, Van Denburgh, 1922, p. 503; *Huachucha Mountains*, A.M.N.H., M.C.Z., C.A.S., Stanford; *8 miles southeast of Light*, M.V.Z.U.C.; *Miller Canyon*, Van Denburgh and Slevin, 1913, p. 407; *Montezuma Canyon*, Van Denburgh, 1922, p. 503, Taylor; *Montezuma Well*, Van Denburgh, 1922, p. 503; *Paradise, Chiricahua Mountains*, Van Denburgh and Slevin, 1913, p. 407, C.A.S.; *Ramsey Canyon*, Van Denburgh and Slevin, 1913, p. 407, Taylor; *Rucker Canyon*, Van Denburgh, 1922, p. 503, Stanford; *Mouth of Rucker Canyon*, M.V.Z.U.C.; *Valley of the San Pedro River*, Taylor; *Sulphur Springs Valley, 18 miles south by southeast of Light*, M.V.Z.U.C.; *Tombstone*, F.M.N.H.; *1 mile northwest of Tombstone*, Burt, Mich.; *Warren*, C.A.S.; *Willcox*, Van Denburgh, 1922, p. 503, U.S.N.M., M.V.Z.U.C.). Coconino County (*Cedar Ranch Wash*, U.S.N.M.; *Colorado Chiquito*, Van Denburgh, 1922, p. 503; *Flagstaff*, Van Denburgh, 1922, p. 503, U.S.N.M.; *Lees Ferry*, Van Denburgh, 1922, p. 503; *Locket Tank*, U.S.N.M.; *Oak Creek*, Van Denburgh and Slevin, 1913, p. 407, C.A.S.; *Tuba*, A.M.N.H.; *Winona*, U.S.N.M.). Gila County (*Carr's ranch at 5,410 feet in the Sierra Oncha region*, M.V.Z.U.C.; *16 miles east of Miami*, Taylor). Graham County (*Ash Flat*, U.S.N.M.; *Camp Grant*, Yarrow, 1882, p. 43, U.S.N.M., Stanford; *Cadazor Springs*, U.S.N.M.; *Turnbull Mountain*, U.S.N.M.). Maricopa County (*25 miles northeast of Phoenix*, Taylor). Mohave County (*Hackberry at 3,500 feet*, Van Denburgh, 1922, p. 503; *Hualpai Mountains*, Van Denburgh, 1922, p. 503, U.S.N.M.; *Mohave Desert west of Yucca*, Carnegie). Navajo County (*Camp Apache*, Yarrow, 1875, p. 558; *Keams Canyon*, U.S.N.M.; *Oraibi*, U.S.N.M.; *Winslow*, U.S.N.M., F.M.N.H.). Pima County (*Catalina Mountains*, C.A.S.; *Fort Lowell*, Coues, 1875, p. 558, U.S.N.M., F.M.N.H., C.A.S., Stanford; *Madera Canyon in the Santa Rita Mountains*, Van Denburgh, 1922, p. 503, U.S.N.M., C.A.S.; *Mount Lemon in the Catalina Mountains at 8,500 feet*, Van Denburgh and Slevin, 1913, p. 407; *Pusch Ridge di-*

rectly opposite Steam Pump, Ortenburger and Ortenburger, 1926, p. 110; *near mouth of Sabino Canyon near Tucson*, Ruthven, 1907, p. 559, A.M.N.H., Taylor; *bank of the Santa Cruz River at Tucson*, Ruthven, 1907, p. 559, A.M.N.H.; *mesa west of Santa Cruz River at Tucson*, Ruthven, 1907, p. 559, A.M.N.H.; *Santa Rita Mountains*, Carnegie; *Sawmill Canyon in the Santa Rita Mountains*, Van Denburgh, 1922, p. 503; *Steam Pump*, Van Denburgh and Slevin, 1913, p. 407, Taylor; *Tucson*, Coues, 1875, p. 603, U.S.N.M., M.C.Z., C.A.S., Mich., F.M.N.H.). Pinal County (*Oracle*, Van Denburgh, 1922, p. 503, U.S.N.M.; *16 miles west of Miami*, Taylor; *Tortillo Mountains*, Mich.). Santa Cruz County (*Agua Caliente Canyon*, Van Denburgh, 1922, p. 503; *Calabassas*, Van Denburgh, 1922, 503, U.S.N.M.; *4 miles north of Crittenden*, Burt, Mich.; *5 miles north of Crittenden*, Burt, Mich.; Fort Buchanan, U.S.N.M.; *Mowry*, Van Denburgh, 1922, p. 503, U.S.N.M.; *Nogales*, Cope, 1900, p. 603, U.S.N.M.; *Santa Rita Mountains near Pete Mountains*, Van Denburgh, 1922, p. 503). Yavapai County (*Camp Verde*, U.S.N.M., A.M.N.H.; *Fort Whipple*, Coues, 1875, p. 620, U.S.N.M.; *Kirkland*, U.S.N.M.; *Mayer*, U.S.N.M.; *Prescott*, Van Denburgh, 1922, p. 503, U.S.N.M.).

COLORADO.—Delta County (*Hotchkiss*, Cary, 1911, p. 27, U.S.N.M.). Garfield County (*Grand Valley*, Cary, 1911, p. 27, U.S.N.M.; *Plateau Creek*, Cope, 1900, p. 597, U.S.N.M.). Mesa County (*Grand Junction*, Ellis and Henderson, 1913, p. 78). Montezuma County (*Ashbaugh's Ranch*, U.S.N.M.; *2 miles east of Cortez*, Colo. Agri. Coll.; *Valley of the Mancos River*, Tanner, 1928, p. 27; *McElmo*, Cary, 1911, p. 27; *McElmo Canyon*, Colo. Agri. Coll.; *Mesa Verde National Park*, Tanner, 1928, p. 27, A.M.N.H., B.Y.U.).

NEW MEXICO.—Bernalillo County (*Albuquerque*, Van Denburgh, 1924, p. 213, U.S.N.M., Baylor, Stanford, Taylor; *Carasal*, Stanford). Chaves County (*Roswell*, F.M.N.H.). Dona Ana County (*Aden*, Bradley, 1919, p. 414; *20 miles northeast of Fort Cummings*, Cope, 1883, p. 11; *Las Cruces*, Van Denburgh, 1924, p. 212, M.C.Z.; *15 miles northwest of Las Cruces*, M.C.Z.; *Mesilla Valley*, Cope, 1900, p. 574, U.S.N.M.; *Near Organ Mountains, 14 miles east of Las Cruces*, Mich.). Grant County (*Gila National Forest on the east fork of the Gila River*, U.S.N.M.; *Gray Ranch in the Animas Valley*, U.S.N.M.; *Hachita*, Van Denburgh, 1924, p. 213, U.S.N.M.; *Lower end of the Playas Valley*, U.S.N.M.; *1½ miles north of Rodeo*, Burt, Mich.; *6 miles north of Rodeo*, Burt, Mich.; *Silver City*, Cope, 1900, p. 603, U.S.N.M.). Guadaloupe County (*Santa Rosa*, Bailey, 1905, p. 44, U.S.N.M.). Lincoln County (*Ancho at 6,150 feet*, Van Denburgh, 1924, p. 213, U.S.N.M.). McKinley County (*Fort Wingate*, Van Denburgh, 1924, p. 213, U.S.N.M.; *Gallup*, K.U.). Otero

County (*Alamogordo*, Stone and Rehn, 1903, p. 33, A.M.N.H., A.N.S.P.; *east of Alamogordo*, Stone, 1911, p. 230; *5 miles south of Alamogordo*, Mich.; *12 miles southwest of Alamogordo*, Mich.; *Alluvial slope east of Alamogordo*, Ruthven, 1907, p. 559, A.M.N.H.; *Dry Canyon east of Alamogordo*, Ruthven, 1907, p. 559, A.M.N.H., A.N.S.P.; *Plains south of Alamogordo*, Ruthven, 1907, p. 571, A.M.N.H.; *Plains west of Alamogordo*, Ruthven, 1907, p. 571, A.M.N.H.; *White sands west of Alamogordo*, Ruthven, 1907, p. 571, A.M.N.H.; *Highrolls*, Mich.). Rio Arriba County (*Abiquiu*, Yarrow, 1882, p. 43; *Espanola*, U.S.N.M.; *Rinconada at 5,600 feet*, Van Denburgh, 1924, p. 213, U.S.N.M.). San Miguel County (*Las Vegas*, Carnegie; *Ribera*, Bailey, 1905, p. 44, U.S.N.M.). Santa Fe County (*San Ildefonso*, Yarrow, 1882, p. 44; *Santa Clara Canyon west of Espanola*, U.S.N.M.; *Santa Fe*, U.S.N.M.). Sierra County (*25 miles northwest of Elephant Butte Dam*, Taylor; *Lake Valley*, Cope, 1883, p. 11). Socorro County (*Magdalena Mountains at Kelly*, McLain, 1899*b*, p. 9, Stanford; *Socorro*, Cope, 1883, p. 11). Valencia County (*Grant*, Stanford).

TEXAS.—Brewster County (*Blackburn's Ranch*, Strecker, 1909*b*, p. 14; *Chitocotol Mountains*, Mich.; *Du Bois Canyon*, Strecker, 1909*b*, p. 14; *Arid strip beyond Elephant Mesa*, Strecker, 1909*b*, p. 14; *east of Glenn Springs*, Mich.; *2 miles north of Glenn Springs*, Mich.; *Juniper Canyon*, Mich.; *Lower Juniper Canyon*, Mich.; *near Paisano*, Strecker, 1909*b*, p. 14, U.S.N.M.; *Terlingua*, Strecker, 1909*b*, p. 14, Baylor). Culberson County (*4 miles west of Kent*, Burt, Mich.). El Paso County (*El Paso*, Van Denburgh, 1922, p. 495, U.S.N.M., F.M.N.H., C.A.S., Baylor, K.U.; *3 miles southeast of El Paso*, Stone, 1911, p. 230; *Ysleta*, Burt, Mich.). Jeff Davis County (*Fort Davis*, Mich.; *Limpia Canyon in the Davis Mountains*, Mich.; *Prude Ranch in the Davis Mountains*, Mich.; *Sleeping Lion Mountains*, Mich.). Pecos County (*4 miles west of Adams*, Bailey, 1905, p. 44; *Fort Stockton*, Bailey, 1905, p. 44, U.S.N.M.). Presidio County (*Marfa*, Bailey, 1905, p. 44, U.S.N.M.). Reeves County (*15 miles east of Balmorhea*, Burt, Mich.; *Pecos*, Brown, 1903, p. 547, U.S.N.M., F.M.N.H.; *Weinacht's Draw*, Mich.). Upton County (*4 miles southwest of Rankin*, Burt, Mich.).

UTAH.—Iron County (*Kamarrah Canyon*, Van Denburgh, 1922, p. 503, U.S.N.M.; *Paragonah Canyon at 5,500 feet*, Van Denburgh, 1922, p. 503, A.M.N.H.). San Juan County (*Bluff*, B.Y.U., A.M.N.H.). Washington County (*Ash Forks at 5,000 feet*, Van Denburgh, 1922, p. 503, A.M.N.H.; *Bellevue*, Idem., p. 503; *Peter's Leap Creek at 5,000 feet*, Van Denburgh, 1922, p. 503, A.M.N.H.; *Zion National Park*, Tanner, 1928, p. 27, B.Y.U.).

CHIHUAHUA.—(*Casas Grandes*, U.S.N.M.; *Chihuahua*, U.S.N.M., F.M.N.H.; *Janos*, U.S.N.M.; *Jimenez*, F.M.N.H.; *Lake*

Santa Maria, Gadow, 1906, p. 339, F.M.N.H.; *Madera*, M.C.Z.; *Pacheco*, M.C.Z.; *San Blas Mountains*, F.M.N.H.; *Sauz*, Gadow, 1906, p. 302, U.S.N.M., F.M.N.H.)

The records for Mexico are as follows:

COAHUILA.—(*Monclova*, U.S.N.M.).

SONORA.—(*Hermosillo*, U.S.N.M.; *Nogales*, U.S.N.M.; *2 miles south of Nogales*, Van Denburgh, 1922, p. 503, U.S.N.M.; *Pinetos Camp, 32 miles south of Nogales*, Van Denburgh, 1922, p. 503, U.S.N.M.; *San Jose de Guaymas*, M.C.Z.; *San Pedro Bay*, Van Denburgh, 1922, p. 503, C.A.S.)

Habitat.—Although many specimens have been collected, comparatively little is known about the habitat of this form. In Colorado, Cary (1911, p. 27) reported it as a medium-sized species "not uncommon in the lowest valleys below 5,500 feet," but said (p. 40) that a single specimen was seen "in the foothills near Golden in a rank growth of grass on a yellow pine slope at 6,500 feet."

A number of these lizards was collected in the arid strip beyond Elephant Mesa in Brewster County, Tex., by Strecker (1909, p. 14). Others were taken farther north in Upton, Reeves, and Culberson Counties by the writer (summer of 1928) in a semiarid, semisandy habitat, characterized by scattered rocks and bramble bushes. In the valley of the Rio Grande, southeast of El Paso, specimens were found in an area of fine gray sand where clumps of grass, bushes, and piles of brush were present to protect them.

A distinctive habitat is occupied by this race runner in New Mexico. A single specimen was secured twelve miles north of Rodeo in an area of fine reddish sand and few rocks, where clumps of mesquite, greasewood, and broomweed were abundant, but here *tessellatus* was frequently seen and 23 examples were taken in a short time. The type of habitat gradually changed as Rodeo was approached and in the region just north of that place the desert shrubbery was much sparser. Here, where rocks and short clumps of grass were common, *perplexus* proved to be abundant, and 22 specimens were taken within an hour, but *tessellatus* was not seen. Likewise, Ruthven (1907, p. 559) found that this lizard inhabits the lower part of the canyons and the stony arroyos on the alluvial slopes at Alamogordo.

In Arizona, at Fort Whipple, "It is the most numerous and characteristic species (Coues, 1875, p. 603). It lives in the high, dry pine and oak woods, about brush heaps, stumps, logs, etc." At Tucson, according to Ruthven (1907, p. 559), it occurs in the lower parts of the canyons and follows down the arroyos on the slopes of the Santa Cruz River where it is a characteristic reptile in the willow-poplar association on the banks. "It may or may not be significant that the only specimen taken in a dry arroyo at Tucson is a 'medium sized' individual with both stripes and spots, while the largest specimens were only found in the willow-poplar association along the streams." Working in the same general region, Ortenburger and Ortenburger (1926, p. 110) found *perplexus* to be "almost as common on the tops of the foothills as down in the canyon. In very few cases was this species found as far down as the wide sandy washes at the mouths of the canyons where it is replaced by *melanostethus* (=*tessellatus*). In general, the local ranges of these two forms do not overlap." While collecting in southern Arizona, the writer found *perplexus* in areas of sand and rocks in which there was little vegetation. Eight miles north of Bernardino it occurred in an open, barren space where its only protection was a few scattered rocks and patches of short grass. Here it was associated with *Phrynosoma cornutum* and *Holbrookia maculata approximans*. In the region of Old Fort Buchanan, two specimens were taken as they were foraging near the top of a high, rocky bank that had been cut for the roadbed below, and near Crittenden *perplexus* was found in a mesquite thicket where the ground was covered by sand and rocks.

Thus, the Sonoran race runner may be regarded as an inhabitant of the transitional rock-sand zone. An area of much fine sand, although preferred by *tessellatus*, is apparently not selected by *perplexus*, and the presence of too many rocks seems also to restrict its distribution. In this manner *perplexus* has avoided the fine sand of the lower districts and the rocks of the higher altitudes, becoming confined chiefly to the foothill region.

General behavior.—The Sonoran lizard is an exceedingly timorous animal, as described by Coues (1875, p. 603), and it darts out of sight at the least alarm. "It is one of the very swiftest of its agile tribe and the eye can scarcely follow it while running at its best on level ground." "It is a ground-dwelling form, and seems not to be able to climb," according to Woodbury (1928, p. 18), who added that "When disturbed it will dart for shelter to a near-by bush or plant. After a rain one was seen to run into a puddle of muddy water to hide.[18] When picked from the pool it lay limp and motionless, but it was, however, ready to spring into action at the first sign of relaxation of the hold on it. One of the rangers reports seeing one of these lizards outrun a *Crotaphytus* which was chasing it."

The general activity of *perplexus* reminds one of its close relative, *sexlineatus*, which occurs to the east. As in that species, the maximum activity seems to be reached in the morning, when many individuals may usually be seen in favorable habitats.

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[18] For a similar observation in regard to *gularis* see p. 119.

Food and feeding habits.—This form is an active feeder. Coues (1875, p. 603) wrote of it as follows: "It used to frequent our tents during the summer, and hunt for flies in a quiet, furtive manner, catching them with great address, and was very favorably regarded by all on this account, although its labors resulted in no sensible diminution of the pests." Although this species is quite at home among the rocks and boulders, it probably feeds exclusively on the ground, as suggested by Ortenburger and Ortenburger (1926, p. 110), who stated that "More than once this whiptail was seen on the sand among the boulders, eating. Its actions remanded us very much of a chicken, except that the forefeet were used for scratching, rather than the hind feet. It usually made two or three scratches with one foot backward and laterally, and then two or three with the other foot. They were in no case observed to make alternate strokes. After every few scratches they would stop to pick up some food by making very rapid, quick movements, again reminding one of a chicken. They showed very little fear, for as this process was observed they continued their activity for several minutes in several instances. They would occasionally turn the head and look at us and then continue eating." According to Ruthven (197, p. 57), the food consists of insects which it picks up from the ground.

The stomachs of very few specimens have been examined. Ruthven found beetles, ants, grasshoppers and spiders in the contents, and Woodbury (1928, p. 18) added caterpillars to the list.

Life history.—The details pertaining to the life history of this form remain practically unknown. Ortenburger and Ortenburger (1926, p. 110) stated that "One evening (July 15) at 6 p. m. a female containing well-developed eggs was dug out of a freshly made hole about 1½ inches in diameter and 1 foot deep. This hole had been dug in the clean sand in a dry stream bed about a half mile up a canyon. There was little doubt that the female caught had dug the hole herself and possibly intended to deposit her eggs there."

Enemies.—One of these lizards was removed from the stomach of a snake, *Salvadora grahamiae hexalepis*, at Fort Whipple, Ariz., by Coues (1875, p. 620).

Affinities.—The closest relative of *perplexus* is apparently *gularis*, with which it now intergrades over an extensive area in northern Mexico on a line extending in general from Guaymas to northern Coahuila, and, in the United States, northward to the panhandle of Texas. Intergrading individuals often have the dorsal markings of *perplexus* and the blue-black ventral coloration of *gularis*, but at times the opposite condition is found. Both of these modifications merge insensibly, one into the other, along the line of intergradation. After considering this definite transition, and the proportional and scutellational identity of the two forms, and the fact that *gularis* is central in position both in relation to the presumably simpler southern stock of *Cnemidophorus* and to the northern *sexlineatus* and *perplexus*, the latter is thought to be a direct derivative of *gularis*. Further support of this view will be presented in the summary of the group (pp. 144–146).

As pointed out under the discussion of the affinities of *sexlineatus*, specimens of that species approach *perplexus* in the panhandle district of Texas and Oklahoma and the two forms probably intergrade along a common boundary here or in eastern New Mexico. Further collecting is necessary before this point can be definitely settled. The differences between *sexlineatus* and *perplexus* are greater than those between *gularis* and *perplexus* and involve scutellational as well as colorational considerations, as shown in the diagnosis of *perplexus*. Therefore, the Sonoran race runner seems closer to *gularis* than to *sexlineatus* and apparently intergrades with the latter only secondarily. The geographical position of the three subspecies and the fact that both *perplexus* and *sexlineatus* intergrade extensively with the central *gularis*, which lies nearer to the presumed center of origin of the genus, but only slightly with each other, tend to indicate that the former subspecies, *perplexus* and *sexlineatus*, are not direct derivatives of one another. Thus, again it is concluded that they are derivatives from the central *gularis*.

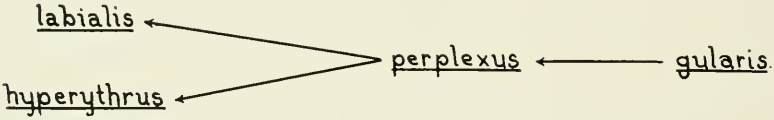

FIGURE 24.—DIAGRAM OF THE RELATIONSHIP OF C SEXLINEATUS PERPLEXUS

The relationship with *deppii* is not direct, as suggested by Gadow (1906), but indirect and through *gularis*, so a consideration of this point is not given here.

As shown in the discussion of the affinities of *labialis*, *perplexus* approaches that species very closely at times and was apparently derived from the same ancestral stock.

An elaboration of the relationship existing between *perplexus* and *hyperythrus* is reserved for presentation in the general summary at the end of this work (pp. 251–260), since this is in reality a consideration of the origin of the *hyperythrus* group from the *sexlineatus* group.

A diagram of the relationships of *perplexus* is given below.

CNEMIDOPHORUS LABIALIS Stejneger

STRIPED RACE RUNNER

1890. *Cnemidophorus labialis* Stejneger, Proc. U. S. Nat. Mus., vol. 12, p. 643 (type locality, "Cerros Island," west coast of Lower California, Mexico; type specimen[19] U.S.N.M. No. 15596, L. Belding, collector).—Cope, Trans. Amer. Philos. Soc., vol. 17, 1892, p. 51.—Boulenger, Zool. Rec. for 1890, vol. 27, "Reptilia," 1892, p. 10.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 5, 1895, p. 128; vol. 6, 1896, p. 345.—Cope, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 610.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 3, vol. 4, 1905, p. 24.—Gadow, Proc. Zool. Soc. London, 1906, p. 374.—Ditmars, Reptile Book, 1907, p. 188.—Van Denbergh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 4, 1914, p. 145.—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 66.—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 504.—Nelson, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 674.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 71.

Diagnosis.—This delicate little race runner may be distinguished by the presence of two frontoparietal plates in comparison with the members of the *hyperythrus* group; and from most other species of *Cnemidophorus* by its retention of an approximately 7-striped pattern throughout life. The middorsal stripe is often forked. There are no spots or reticulations on the body, but the femora are prominently reticulated or striped with white lines. The ground color between the two lower lateral stripes on each side is lighter and usually bright reddish brown as in *danheimae*. The external ventral plates are brilliant blue in color. *C. labialis* differs from most of the 7-lined specimens of *perplexus* by the contact of the anterior nasal with the second labial, and from variants of that form (such as the type of *arizonae*) which possess this diagnostic feature, by a low number of femoral pores, usually less than 14.

Description.—Snout moderately pointed; nostril anterior to nasal suture; anterior nasal usually in substantial contact with second upper labial; supraoculars 4; granules not extending forward past the middle of the third supraocular, and very rarely beyond the posterior border of the third supraocular; frontoparietals 2; parietals 3; anterior gulars moderately large, rather uniform in size; posterior gulars smaller; mesoptychial scales moderate to large, largest on posterior edge, growing smaller and smaller anteriorly, larger rows 4–6; postmesoptychial granules very fine, none on edge of posterior gular fold.

Body moderately elongate; ventral scutes arranged in 8 longitudinal and 30–33 transverse rows; dorsal granules moderately fine; limbs not suggestive of strength, but well developed; branchials 3–5;

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[19] For important data pertaining to the type specimen and the type locality see the footnote under the reference to the type of *Verticaria beldingi*, which was also described from Cerros Island (p. 226).

antebrachials 2–3; brachials and antebrachials rather continuous at a point of contact; postantebrachium with a few enlarged granules; femorals 4–7; tibials 3–4; femoral pores 11–14; tail elongate, tapering; caudal plates large, oblique, not with distinct longitudinal keels laterally.

Coloration only moderately distinctive, relatively constant from young to adult; uniform bluish or grayish below, with a deeper tint of color at the sides of the abdominal region; stripes continued on tail; tail light brown distally, darker proximally; femora distinctly lined or reticulated with white; dorsal ground color brownish gray, the space between the lower lateral stripes (field 1) usually somewhat lighter than the color of the other fields and usually reddish or reddish brown; all specimens with three prominent stripes on each side, and in addition a vestige of a fourth pair anteriorly at base of or directly posterior to the tympanum; one or two middorsal stripes present, often one which is more or less forked anteriorly.

Only seven specimens of this species, including the type and paratypes, have been available for this study. The data secured from them may be summarized as follows: Body, 50–53 mm.; tail, 120–131; total length, 170–183; length of tail as percentage of total length, 70. 4–71. 5; width of head, 6. 5–7. 0; width of head as percentage of body length, 13–14; hind leg, 35–37; length of hind leg as percentage of body length, 70–72; supraocular granules not extending forward past the anterior border of the fourth supraocular in the specimens examined.

The amount of contact between the anterior nasal and second upper labial varies from a mere touching to an overlap of nearly one-half the length of possible contact surface between these scutes.

The condition of the lateral striping is constant, but that of the middorsal area is highly variable. In U.S.N.M. No. 15598, a single, wide, dorsal light streak is present. A close analysis shows this streak to be made up of two white stripes lying side by side. Another specimen (U.S.N.M. No. 15597) represents the transition from two complete dorsal stripes to one, having an anterior fork which is 75 per cent as long as the entire dorsal area, fork and all. In other examples (U.S.N.M. Nos. 21501, 15599–15600, and C.A.S. No 55810) a single middorsal stripe is present, but it is found that the line is of uneven width, being noticeably wider anteriorly. In the type specimen a single dorsal stripe is widened and slightly forked just back of the occiput.

Range.—This little lizard inhabits sections of the northern half of Lower California. Specimens have been examined from the following localities: *Cerros Island* (Stejneger, 1890, p. 643, U.S.N.M.); *San Quentin* (C.A.S.).

Habitat and habits.—Nothing is known concerning the habitat and habits of this lizard. Mr. Slevin has informed the writer that he has made strenuous attempts to collect this interesting and rare species on Cerros Island during his more recent collecting expeditions to Lower California, but that he has always failed.

Affinities.—The definition of the affinities of this species is difficult. Gadow (1906) was much puzzled over the relationships and wrote as follows: "The arrangements of the labials and nasals is unique. The condition of the collar is essentially that of the *tessellatus* group, but recalling the *gularis* group by its sharp edge without granules. However a very similar collar is given to *octolineatus* and *inornatus* in Cope's figures. The slightly enlarged granules on the forearm point to *deppii* and *sexlineatus* to which latter it is more closely related by the color pattern. The three peculiar pale stripes on the hind limb recall the three equally peculiar stripes of *martyris*."

Because of its geographical position and characters, particularily the possession of two frontoparietal plates, *labialis* is here regarded as a member of the *sexlineatus* group. The retention of the striped condition throughout life is characteristic of the entire *hyperythrus* group, and its appearance in *labialis* would be more significant if it were not also entirely characteristic of *sexlineatus* itself.

The irregular placing of the longitudinal caudal keels and the low number of femoral pores found in *labialis* show as much variation from typical *hyperythrus* as from typical *perplexus*, so these characters give no clue to the origin of the form. However, for reasons to be given in the general discussion at the end of this work (pp. 251–260), the *hyperythrus* group is presumed to have been derived from the *sexlineatus* group through a common ancestral stock with *perplexus*. The same transient stock that produced *hyperythrus* apparently gave rise to *labialis*, too, the latter becoming differentiated before the union of the frontoparietal elements, the former differentiating later by such change. Even today *labialis* is largely intermediate between *hyperythrus* and *perplexus*, for the retention of a high number of dorsal stripes and the lack of differentiation between the dorsolateral (upper or third pair) and lateral stripes suggest *perplexus*, while on the other hand, the small size of the body in adults and the frequent forking of the middorsal stripe are specializations clearly in the direction of *hyperythrus*.

The most emphasized characteristic of *labialis*, the contact of the anterior nasal with the second upper labial, is of lessened importance because of its variability. This feature is often found in other forms of *Cnemidophorus*, and the contact between these two elements is varied from a mere touching to broad contact in the known specimens of *labialis*. Moderate contact in a specimen of *perplexus* from southern Arizona lead Van Denburgh (1896*b*, p. 344) to describe it as a new species, *C. arizonae.* This specimen of *perplexus*, like many others, has a strong resemblance to *labialis*, and differs merely in the increased number of femoral pores, in the color of the sides, and in a more stable character of the dorsal striping.

Thus, *labialis* may be considered as a derivative of *perplexus* stock, specialized somewhat in the direction of *hyperythrus.*

SUMMARY OF THE SEXLINEATUS GROUP

The *sexlineatus* group is largely confined to the mainland of the United States, Mexico, and Guatemala. Representatives occur on some of the bordering islands off the coast of southern Mexico, western Lower California, Texas, and the eastern United States, but they are absent from most of the islands in the Gulf of California. All of the forms agree in having the sides of the young striped, and in the normal possession of two frontoparietal plates and four supraoculars.

The group is composed of four forms, *gularis*, the only one from which the remaining members can be easily and simply derived, and its three mainland derivatives, *sexlineatus*, *perplexus*, and *labialis*. A consideration of the genetic origin of the group as a whole, and hence of the prototypic *gularis*, is given in the general summary at the end of this work (pp. 251–260), so the present discussion will be limited to the origin and relationships of the three derivatives.

The range of *gularis* is clearly intermediate between that of the remainder of the *sexlineatus* group and that of the modern representatives of the presumably more primitive *deppii* and *lemniscatus* stocks. *Gularis* in its present area is geographically intermediate between the eastern off-shoot, *sexlineatus*, and the western derivatives, *perplexus* and *labialis*, and many intergrading individuals between *sexlineatus* and *gularis*, and between *gularis* and *perplexus*, have been examined. *Sexlineatus* was apparently independently derived from *gularis* stock in eastern Texas and, although it has differentiated and spread as a distinct form throughout the lower levels of the eastern United States, including the southeastern coastal plain, it still intergrades with *gularis* in southern Oklahoma and in eastern Texas. Since there is little contrast in the types of habitat found in this region, there is no sharp delineation of these subspecies here and the resulting belt of intergradation is therefore unusually wide. In the Panhandle region of Texas and Oklahoma *gularis* and *sexlineatus* approach *perplexus*, both geographically and in their characteristics, and probably all three subspecies intergrade here. Lack of specimens prevents further elaboration or proof of this theory. Since *perplexus* occupies the arid Sonoran region and since intergrades appear in a rather sharply delineated belt from the Panhandle of Texas, southward to Coahuila and west to the Gulf of California, *perplexus*, like *sexlineatus*, is thought to have been derived directly from *gularis*. In view of the distributional facts, it would appear that any intergradation which takes place between *perplexus* and *sexlineatus* is purely secondary. This theory is supported by structural and colorational data discussed under the affinities of these forms (pp. 96, 139–140).

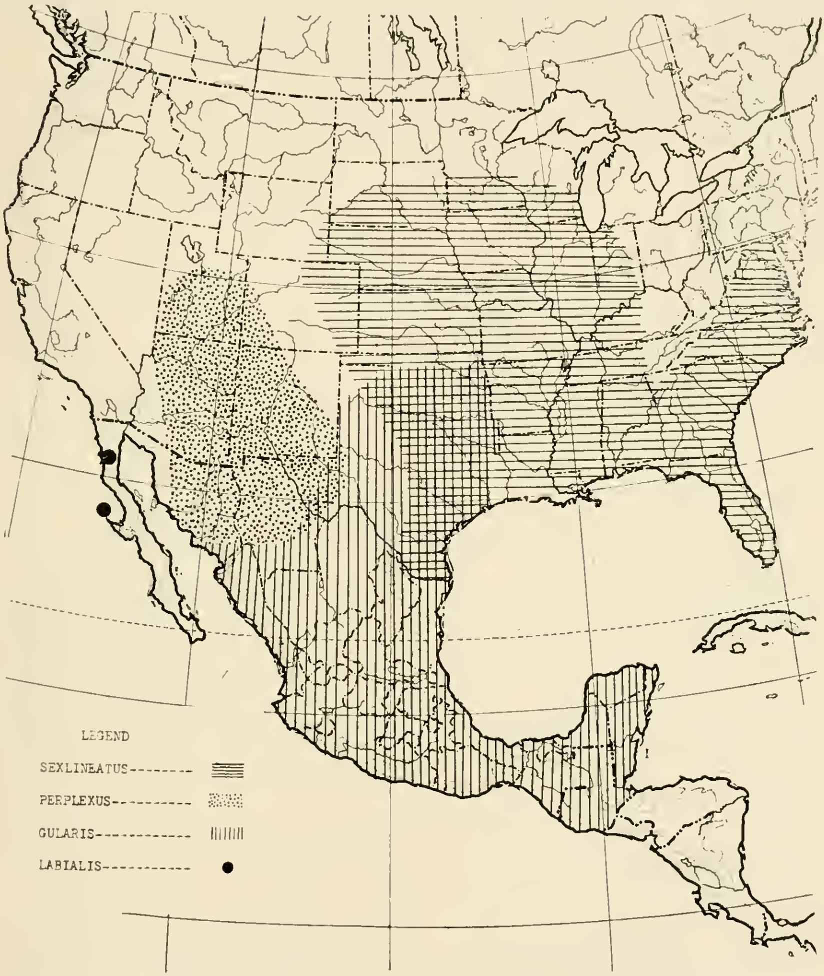

Figure 25.—Map showing distribution of the forms of the sexlineatus group

The recent finding of *labialis* at San Quentin on the mainland of Lower California, far to the north of Cerros Island, the type locality, excludes the possibility, apparently, of its recent speciation through the agency of insular isolation. The frequent forking of the dorsal stripes in *labialis* suggests *hyperythrus*, but the structural affinities, as well as other colorational features, are with *perplexus*. This intermediate coloration, and the normal possession of two frontoparietal plates, make it fairly certain that the ancestral *labialis-hyperythrus* stock came from an ancient form very much like the present *perplexus*. It is believed that *labialis* became independent, when a section of this stock gave rise to the immediate ancestral population of *hyperythrus* through the union of the frontoparietal elements.

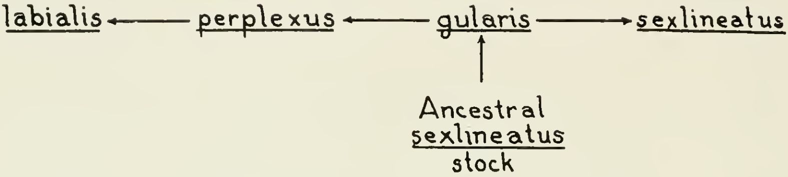

FIGURE 26.—A DIAGRAM OF THE SUPPOSED RELATIONSHIPS WITHIN THE SEXLINEATUS GROUP

The writer's interpretation of the genetic relationships within the *sexlineatus* group are expressed by the foregoing diagram.

THE TESSELLATUS GROUP

CNEMIDOPHORUS TESSELLATUS TESSELLATUS (Say)

DESERT WHIPTAIL, TESSELLATED LIZARD, TIGER LIZARD

1823. *Ameiva tesselata* Say, Long's Exp. Rocky Mts., vol. 2, p. 50 (type locality, "Arkansas River, near Castle Rock Creek, Colorado").—Harlan, Journ. Acad. Nat. Sci. Phila., vol. 6, 1827, pp. 8, 37.—Gray, Synops. Reptilia, appx. to Griffith's "Cuvier's 'Animal Kingdom'," 1831, p. 30.—Harlan, Med. and Phys. Researches, 1835, pp. 136, 162.—Baird and Girard, Reptiles, in Stansbury's "Expl. and Surv. of the Valley of the Great Salt Lake of Utah," appx. *c*, 1852, p. 338.—Hallowell, Proc. Acad. Nat. Sci. Phila., 1854, p. 94; Reptiles, Pacific R. R. Surv. (Williamson route), vol. 10, pt. 4, no. 1, 1859, p. 9.

1834. *Ameivam tesselatum* Wiegmann, Herpetologia Mexicana, p. 27 (footnote).

1842. *Ameiva tessellata* De Kay, Zool. of N. Y., pt. 3, Reptiles and Amph., p. 30.—Garman, Bull. Essex Inst., vol. 16, 1884, p. 12.

1852. *Cnemidophorus tesselatus* Baird and Girard, Reptiles, in "Stansbury's 'Expl. and Surv. of the Valley of the Great Salt Lake of Utah'," appx. *c*, p. 338.—Baird, Reptiles, Pacific R. R. Surv. (Gunnison and Beckwith routes), vol. 10, pt. 5, no. 3, 1859, p. 18.—Gadow, Proc. Roy. Soc. London, vol. 72, 1903, pp. 110, 121.

1852. *Cnemidophorus gracilis* Baird and Girard, Proc. Acad. Nat. Sci. Phila., p. 128, (type locality, "Desert of Colorado"; type specimen, U.S.N.M. No. 3034, J. L. LeConte, collector); Proc. Acad. Nat. Sci. Phila., 1852, p. 301; Reptiles, Expl. Red River of La. (1852), 1853, p. 239.—Baird, Reptiles, Pacific R. R. Surv. (Gunnison and Beckwith routes), vol. 10, pt. 5, no. 3, 1859, p. 10.—Cope, Proc. Acad. Nat. Sci. Phila., 1863, p. 104; 1866, pp. 310–311.—Peters, Monatsber. Berl. Akad. Wiss, 1869, p. 63.—Günther, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—Cope, Bull. U. S. Nat. Mus., vol. 32, 1887, p. 45.

1852. *Cnemidophorus grahamii* Baird and Girard, Proc. Acad. Nat. Sci. Phila., p. 128 (type locality, between San Antonio and El Paso del Norte, Tex.; 2 cotypes, U.S.N.M. No. 3036, Col. Graham, collector); Reptiles, Expl. Red River of La. (1852), 1853, p. 239.—Baird, Reptiles of the Boundary, U. S.-Mex. Boundary Surv., 1859, p. 10.—Cope, Proc. Acad. Nat. Sci. Phila., 1863, p. 104; Bull. U. S. Nat. Mus., No. 1, 1875, p. 45.—Yarrow and Henshaw, Ann. Rept. Chief of Engineers to the Sec. of War for the year 1878, pt. 3, appx. L, in "appx. NN," 1878, p. 1640.—Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 45; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 42; Proc. Acad. Nat. Sci. Phila., 1892, p. 335.—Palacký, Zool. Jahrb. (Abt. Syst., Geog. u. Biol.), vol. 12, 1899, p. 253.—Strecker, Baylor Univ. Bull., no. 13, 1910, p. 8.—Stone Proc. Acad. Nat. Sci. Phila., 1911, p. 230.—Strecker, Baylor Univ. Bull., no. 18, 1915, p. 25.—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 66.—Ruthven, Geog. Rev., vol. 10, 1920, p. 243.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 71.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 4, vol. 13, 1924, p. 213.—Strecker, Contr. Baylor Univ. Mus., no. 16, 1928, p. 13.

1852. *Cnemidophorus marmoratus* Baird and Girard Proc. Acad. Nat. Sci. Phila., p. 128 (type locality, "Between San Antonio and El Paso del Norte, Texas"; 2 cotypes, U.S.N.M. No. 3024, J. H. Clark, collector); Reptiles, Expl. Red River of La. (1852), 1853, p. 239.

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1922. *Cnemidophorus aethiops* VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, p. 533.

1928. *Cnemidophorus tesselatus tesselatus* WOODBURY, Copeia, no. 166, p. 18.

Systematic notes.—A great amount of variation, chiefly colorational, exists in the specimens of this subspecies that have been examined during the progress of this study. However, all 4300 examples have been found to possess certain diagnostic features (given on p. 173) which combine them into the single taxonomic unit.

The above synonymy is extensive and, in order that those who maintain an interest in the sectional "species and subspecies" included in the list may see the reasons for such action, the following account is presented.

C. tessellatus tessellatus was first described by Say in 1823 as *Ameiva tesselata*[20] and, although the type has been lost, there is no doubt as to its identity with the present subspecies. From this time until the period of the exploring expeditions, sent out by the United States Government from about 1850, apparently no additional specimens of this lizard were reported. In 1852 Baird and Girard published short descriptions of four new *Cnemidophori* from the collections of these expeditions, all of which are here regarded as synonyms of *tessellatus*. Three of these, *marmoratus*, *gracilis*, and

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[20] It will be noticed that the specific name, *tesselata*, was spelled with one "l" in the original description. Since the derivation of the name is obviously from the adjective "tessellated" which describes the dorsal pattern of the lizard, the use of one "l" constitutes a misspelling. Therefore, the specific name is corrected to read "*tessellata* (*us*)" in the present work, following De Kay (1842, p. 30). This is interpreted to be in accordance with article 39 of the International Rules of Zoological Nomenclature.

tigris, will be discussed here, but the fourth, *grahamii*, will be considered later with *stejnegeri*.

The Texas form, *marmoratus*, was separated from *tigris* by the following features: "Smaller scales on back; larger scales on head and belly; broader head on vertex; difference in shape of cephalic plates; greater development of hind legs; and greenish ground color." With the accumulation of additional material it became evident that the diagnostic characters advanced were all due to either age or individual variation, and consequently *marmoratus* was early reduced to synonymy. The type specimen is in fairly good condition. There are a few black spots on the sides of the head and on the throat, and this is continued as a black mottling on the chest and abdomen. All of the dorsal lines are broken and irregular and the tessellation of the sides is complete. A co-type has the same coloration. From this description it is evident that *marmoratus* represents a transition from the typical dull colored, brown-backed specimens of the desert levels of the Great Basin to the dark-mottled form of the rougher, less sandy districts, which reaches its end development in what has been described from Texas as *grahamii* and from the west coast as *stejnegeri*. The *undulatus* of Hallowell, which because of preoccupation became the *mundus* of Camp, is the Californian representative of this particular color phrase. These statements are to be taken only in a general way, however, because almost everywhere that *tessellatus* ascends to higher levels, even in the Great Basin itself, transition toward the *grahamii-stejnegeri* phase is seen.

The type of *gracilis* was said to differ from *perplexus* (which is here considered as only a distant relative) in the narrower head; in the proportionately longer body, tail and legs; and in the smaller scales on the lower surface of the head and throat. With our increased knowledge of the variation exhibited by *tessellatus* and *perplexus*, it is very doubtful if any part of this diagnosis would hold to-day. The type is a young desert specimen with a slaty throat and with considerable blackish suffusion below, and is indistinguishable from the young of what has been called "*melanostethus*" by Cope. There are traces of six stripes on the body, instead of four as stated in the original description, but those on the sides are becoming broken into tessellations, while those on the back are only slightly irregular. Like *marmoratus*, this form is indistinguishable from *tessellatus*.

The Utah species, *tigris*, was described as follows: "Scales on the subguttural (posterior gular) fold small in size; four yellowish indistinct stripes along the dorsal region." The former character is diagnostic of most of the specimens of the entire *tessellatus* group, and the latter is more or less characteristic of *tessellatus* everywhere. Neither has been found to be a reliable diagnostic feature, however, since too much variation exists in both. In spite of its weak diagnosis, this species was given recognition by general workers until the event of Stejneger and Barbour's check list in 1917. Baird and Girard (1852d, p. 338) wrote in their section of Stansbury's report as follows: "We have no doubt that the lizard referred to in Long's expedition, under the name of *Ameiva tesselata*, will come under this genus, and be closely allied to our species, *tigris*. No specimen of this (*tessellatus*) being extant at the present time in any known collection, a direct comparison * * * is not possible." And later, Baird (1859, p. 18), in reporting on a specimen collected in the Salt Lake Basin of Utah, was forced to say that "The specimen appears more nearly referable to this long lost species of Say (*Cnemidophorus tessellatus*) than to any other, although closely related to *C. tigris*." In 1875 Cope gave recognition to *tigris* in his check list, and while Yarrow and Henshaw (1878, p. 1641) expressed the belief that *tessellatus* and *tigris* should be united, they followed Cope in giving them practical recognition as distinct forms.

An examination of the type of *tigris* shows it to be something like those of *marmoratus* and *undulatus* (or *mundus*) in color pattern, rather than like the many more brownish specimens that have been recently collected in Utah. Therefore, it probably came from the higher, more mountainous, less sandy levels. The tail is very light brown at the tip, almost salmon in fact, a condition that almost suggests *rubidus* of Lower California.

Apparently the first attempt to give critical thought to the question of the value of *tigris* as a specific name was that of Stejneger (1893, p. 198), who wrote the following: "Owing to the fact that nearly the entire collection of North American *Cnemidophori* are inaccessible to me at the present writing, I have been unable to settle the question as to the proper name of the present species to my own satisfaction. It may be that *C. tigris* is only a synonym pure and simple of *C. tessellatus* (Say) or they may be trinomially separable. I have therefore retained the name *C. tigris*, as the specimens before me agree perfectly with the type of the latter." After considerable and increasing variation in the designation used for *tessellatus* had been displayed, Stejneger and Barbour (1917) merely listed the Great Basin form as *C. tessellatus tessellatus*, thus submerging *tigris*, and since that time their nomenclature has been generally accepted by working herpetologists.

The systematic notes on the remaining species are presented below, in two series according to the general type of habitat that they represent. The first of these inhabits the lower levels, particularly the desert floor of the Great Basin and of certain low-lying islands in the Gulf of California. Here there is usually sand in abundance and the sand itself is the chief protection of the species. Here the burrowing habit, or the habit of running into the numerous small holes in the sand, especially at the foot of bushes, is usually well developed. In this environment it is an advantage to have a coloration like the sand, reddish or brownish, and one that is as near unicolor as possible. Without going into a scientific explanation for the reason for such a development, it may be stated that such a coloration has actually developed in the sandy areas. This appears to have been accomplished by the gradual dissolution, diffusion and concentration of dark pigment from the dorsal to the ventral surfaces, where it is found on the throat, chest, and abdomen. This results in the blending of the dark and light reticulations of the back into a dull, although still tessellated, pattern. In some instances the light longitudinal dorsal lines, which are usually four in number in the young and often in the adult of both sections, become multiplied into many lines here, and in other cases the populations tend to become spotted, rather than reticulated. Still another modification lies in the fact that specimens, especially in the south part of the range, may lose almost all traces of longitudinal arrangement of the dorsal markings, thus approaching the group of species which have been described from the Gulf of California as *martyris*, *canus*, *bacatus*, and *catalinensis*. As will be seen in tracing these tendencies, it appears that none of them is confined to a distinct, continuous, geographical area, so the splitting off of subspecies seems out of the question.

The second series inhabits the higher levels, particularly the foothills of the mountainous districts of the west (Oregon, California and Lower California) and the same situations in the east (Western Colorado, Texas, and Chihuahua). Here sand is usually replaced by gravel, or even rocks, and either the rocks or simply brush become the chief protection of the species. Here the burrowing habit may be rendered impossible of development, and since the holes in the soil are usually fewer, the species is often forced to take refuge under rocks or brush when in danger, or to depend upon its swiftness and "protective coloration" to deliver it from its enemies. In this environment it is no doubt an advantage to have a broken, sharply contrasting pattern to give the impression of light and shade beneath the shrubbery or of some lifeless debris upon the ground. Since the color of the surroundings is dark, and not reddish or brownish as in the desert, a dark ground color for concealment is clearly an advantage. The coloration of these lizards thus appears to be an adaptation to the environmental conditions of this habitat. This coloration appears to be due to a localization and concentration of the dark pigment on the upper surfaces instead of the lower ones. The resulting intensification of this pigment is accompanied by a better definition of the light sections of the color pattern. Here, in the upper levels, the under surfaces are usually white, often with only a few black spots, which, however, are usually well developed and prominent, although at times absent. In this environment the lizard is conspicuous only when viewed on an extensive, unicolored background.

Some discussion in support of the general views just expressed occurs in the literature. In the region of Death Valley there is a great deal of variation in the amount of black markings and in their intensity (Stejneger, 1893). "The dorsal pattern is quite distinct in some, while in others it looks as if it had faded out. On the other hand, the black suffusion of the throat and breast is equally variable, but neither sex, age, season, nor locality seems to account for this variation, except that is is usually absent in the youngest." Later writers have agreed with Stejneger in general, but evidence of local variation was advanced by Meek (1905, p. 13) who found that "Individuals of this species living in sandy areas are much lighter than those living in the mountains." Another conclusion of the same sort is suggested by Gadow (1906, p. 370), who wrote, while synonymizing *stejnegeri* with *tessellatus*, that "It would be interesting to ascertain to what extent the more distinctly striped individuals coincide in their habitat with those districts which are decidedly not deserts, as in Texas (*grahamii*) and California (*mundus* and *stejnegeri*)." As outlined above and maintained below, this coincidence is here held to be very striking.

Examples from sandy areas in the Turtle Mountains of southeastern California have the dorsal markings almost obliterated, as noted by Camp (1916, p. 529), while those from the higher levels are darker and with much more distinct dorsal markings. Both in specific localities and in general regions this tendency seems to hold and, as found by Atsatt (1913, p. 39), "On a general survey of masses of material one feels that the effect of the environment upon the individual has been great." Quoting further, we find that "Associated with the dryness and intense light of the desert environment there seems to be a sharp contrast in the extremes of light and dark in the color patterns of the reptiles. With the colors of the yellow, buff and brown sands of the higher levels and of the Pacific area the ground hues of *Phrynosoma blainvillii blainvillii*, *Cnemidophorus stejnegeri*, *Lampropeltis getulus boylii* and *Crotalus ruber* harmonize, while the patterns themselves have the darker shades of that group of colors. In the yet higher altitudes * * * where the light is subdued by the large amount of shade and the dark colors of the foliage and where the air is more humid, the darkening of color is observed. Of course, in some localities there are exceptions to these statements * * * but on the whole the general background colors of the country seem to be reflected in the coloration of the reptiles."

The desert forms to be discussed under the *first section* designated above are as follows: *melanostethus*, *variolosus*, *aethiops*, *disparilis*, *estebanensis*, *punctilinealis*, and *dickersonae*.

The first of these, *melanostethus*, described by Cope (1863), was said to have a shorter hind foot than *gracilis*, and not to exhibit that abrupt transition from the small posterior to the large anterior gular plates shown by *tessellatus* and *tigris*. Also, the coloration was said to be different in that *melanostethus* was largely black beneath. Through general study it has been found that the young of lizards usually have proportionately longer hind legs than the adults. Since the type of *gracilis* is a young specimen and that of *melanostethus* an adult, the shorter hind leg in *melanostethus* is to be expected. (Data showing variability in the length of the hind leg are presented below on page 175 under the subject of variation). The type of transition between the anterior and posterior gular scales is highly variable when series are examined and may be regarded as largely an individual characteristic.

The coloration of the best developed examples of *melanostethus* often seems, at least superficially, diagnostic and distinctive, since typically the lower surfaces are covered by a more or less continuous black or dusky suffusion. Therefore, *melanostethus*, although sometimes "philosophically" questioned, has been given general recognition until the present time. An examination of the types, which came from the Colorado River, "California," proves them to be less characteristic of what might best be called "*melanostethus*" than certain specimens of other regions or even of the same general area, since they show a mixture of both black and white on a slaty ventral surface. Such specimens may logically be regarded as intermediates between the extreme dark and white ventralled phases of *tessellatus*, but in this instance the dark phase is apparently favored.

Van Denburgh became interested in this problem in 1896 (p. 344) and wrote as follows: "I have been unable to detect any difference between *Cnemidophori* from southeastern Arizona and specimens of *tigris* from Idaho and California, except that the adults from the former locality have throats suffused with intense black, while in *tigris* this region is usually grayish slate. The types of *melanostethus* are more nearly like *tigris* than like specimens from southeastern Arizona, but their paleness may be seasonal rather than geographical. When more specimens have been collected it may become necessary to regard *melanostethus* as a synonym of *tigris*."

Gadow (1906, p. 373) who, however, saw very few specimens, considered *melanostethus* a smaller and nigrescent form closely allied to *tessellatus*.

It is surprising that Van Denburgh (1922, p. 532), after his years of experience with western forms, should have written as follows: "The types of *melanostethus* were said to have been collected near the Colorado River. They do not have the intense black throats of many of the Arizonan specimens and it may be that they do not belong to the form described above, but rather to *C. tessellatus tessellatus*. Cope's *C. tessellatus aethiops* from Hermosillo, Sonora, is based on specimens not distinguishable from those described above. If further studies confirm these views, this name, *C. aethiops* (Cope), will replace *C. melanostethus*." It will be noted that Van Denburgh admitted the uncertainty as to the classification of the types of *melanostethus*, correctly indicating that they are intermediate between the forms of *tessellatus* with the darkest and lightest lower surfaces, and yet with these intermediates and with numerous others at hand, he was willing to overlook the fact of intergradation and recognize the darker-ventralled variants as a distinct *species*. It is true that *aethiops* is deep black below, as stated, but nevertheless it appears that Cope (as opposed to Van Denburgh) was entirely justified in describing it as a tentative subspecies, rather than as a full species.

The range of the most typical population of *melanostethus* in the United States is "The deserts of southern Arizona" as stated by Stejneger and Barbour (1923, p. 72). Even here the young specimens can scarcely be distinguished from those of the light phase of many other regions. Specimens of intermediate size are usually darker, and the adults of both sexes in the most "favorable" regions almost always have deep blackish throats and often deep blackish breasts as well. In rarer cases the entire under surface is dark colored. Series usually show individual variation in regard to the intensity and extent of the dark ventral suffusion, which is light slate in some, but deep, shiny black in others.

In the United States outside of Arizona, many specimens, typically *melanostethus*, have been found, but these have always been reported as *tessellatus*, due probably to their *unexpected* geographical position and the appearance of light-ventralled or intermediate specimens with them. The specimens in question have been taken as follows:

CALIFORNIA.—Inyo County (*Independence*, M.V.Z.U.C.): San Bernardino County (*Needles*, C. A. S.).

IDAHO.—Ada County (*Snake River, 8 miles below Swan Falls*, M.V.Z.U.C.).

NEVADA.—Washoe County (*near head of Pyramid Lake*, Stanford).

There are many locality records for specimens with a ventral coloration which may be interpreted as intermediate between the dark and light extreme. Series of specimens from these localities are so varied that some examples may be identified with one extreme and some with the other, even in the adult stages. The list of these localities follows:

ARIZONA.—Cochise County (*Fairbank*, Stanford); Pinal County (*16 miles west of Miami*, Taylor); Mohave County (M.V.Z.U.C.); Pima County (*Tucson*, A.M.N.H.); Yuma County (*Yuma*, U.S.N.M., Taylor).

CALIFORNIA.—Imperial County (*Pilot Knob*, M.V.Z.U.C.); Inyo County (*Argus Range*, U.S.N.M.; *Coso Mountains*, U.S.N.M.; *Emigrant Canyon*, F.M.N.H.; *Grays at 6,000 feet, Kearsarge Pass*, M.V.Z.U.C.; *Laws*, M.V.Z.U.C.; *Long Pine*, U.S.N.M.; *Panamint Mountains*, M.V.Z.U.C; *Wild Rose Canyon*, M.V.Z.U.C.); Mono County (*Benton*, M.V.Z.U.C.); Riverside County (*Palm Springs*, M.V.Z.U.C.); San Bernardino County (*Horn Mine*, M.V.Z.U.C.).

NEVADA.—Elko County (*Carlin*, U.S.N.M.); Humboldt County (*Big Creek Ranch*, M.V.Z.U.C.); Washoe County (*Near head of Pyramid Lake*, Stanford; *Wadsworth*, U.S.N.M.).

NEW MEXICO.—Ostero County (*Alamogordo*, A.M.N.H.); Sierra County (*Elephant Butte Dam*, Taylor).

UTAH.—Beaver County (*Beaver Creek*, A.M.N.H.); Washington County (*Bellevue*, A.M.N.H.).

The areas from which these "intermediates" have been taken are not confined to a definite point or line of contact between the two diverging extremes, as will be seen from the list, and the common appearance of both darker and lighter forms over most of the Great Basin makes it impossible to recognize *melanostethus* as even a distinct subspecies. It merely represents the extreme development of the tendency for the black pigment in the coloration to concentrate ventrally, instead of dorsally, which is so characteristic of many of the populations of these whiptails in the most extensive sandy areas.

A southeastern form from Parras, Coahuila, was described as a species, *variolosus*, by Cope (1892, p. 39), but it was reduced to subspecific rank under *tessellatus* by the same author in 1900, and in 1906, Gadow completely synonymized it with *melanostethus*. The most striking feature attributed to *variolosus* was the absence of stripes. If it were not for the fact that certain specimens of *tessellatus* from Smith Island (Gulf of California), Chihuahua, Arizona, Texas, Utah, and other places, also show early tessellation and lose nearly all traces of longitudinal arrangement in the dorsal markings, such a character might have proved of value. The type of *variolosus* is small and has the general ventral coloration of young "*melanostethus*" the gular region is blue-black and the chest a shade darker. The dorsal pattern includes many light and dark reticulations and spots, without traces of lines. except in a few places where there is a longitudinal arrangement of the dorsal markings.

It must be admitted that the type is relatively small for so advanced a degree of tessellation, just as are all examples of the insular subspecies, *martyris* and *canus*, which are here being recognized as distinct. The diagnostic feature of the latter forms, degree of melanism, is not constant in the three specimens of *variolosus*, the type and two examples from Lerdo in Nuevo Leon (F.M.N.H. No. 1401), for two are light like *canus* and one is dark like *martyris*. The difference between the Lower Californian *martyris* and *canus*, and this Mexican *variolosus*, is very slight, and is apparently only a matter of relative coarseness of the dorsal reticulations, which are never extremely fine in the latter form. In view of this, if the striped Mexican examples of *tessellatus* (called *aethiops* by Cope, see below) were universally converted into the *variolosus* type in the intervening Sonora, and if *all* of the northern specimens were striped, it would be necessary to consider these southern variants as a valid geographical race of *tessellatus*. But, since the type of differentiation shown has no geographic constancy and appears in fact to represent but a mere variation in the general population of *tessellatus*, *variolosus* can not be maintained as a distinct taxonomic entity. *Martyris* and *canus*, however, appear to be constantly differentiated island types in coloration, although but slightly varied from *tessellatus*. Considered by themselves, these insular types are sufficiently differentiated from each other. They show an extreme development in the fineness of their tessellations that is not reached, and is indeed seldom even approached, in *tessellatus*. Yet future specimens, particularly from northern and central Mexico, may make it impossible to use the diagnoses given here for these island subspecies, and it seems very unlikely that better ones will be found.

From Hermosillo, Sonora, Cope (1900, p. 582) described his *C. tessellatus aethiops*. There were six cotypes, and one of these, the smallest, is *perplexus*. The latter is mentioned in the original description as "A smaller and probably young specimen which nevertheless contains two eggs." It is also the one that was "distinctly striped." The remaining remarks on *aethiops* refer to the other five specimens.

According to Cope's description, "*C. tessellatus aethiops* most resembles *melanostethus*, but the coloration is different in several respects. The uniform black color of the adults is unknown in the latter, and the striping of the legs, especially of the hind legs in the adult, is equally a peculiarity of the present form. The possession of six stripes instead of four * * * alters this form to *perplexus* rather than to *melanostethus*." The above statements seem to require elaboration and explanation. The types of *aethiops* are in very poor condition and the pattern is faded and darkened, except in one specimen (U.S.N.M. No. 64241). The appearance of a blackish suffusion dorsally, especially over the scapular region, is by no means rare in *tessellatus*, particularly in some parts of Arizona. When the black suffusion covers the entire lizard, however, one may suspect artificial staining or darkening, perhaps, since melanism usually progresses with the addition of black pigment to one part and the loss or subtraction of that pigment from another. Thus, in most of the Arizonan specimens which have a deep black suffusion over the scapular region, the posterior part of the back is usually practically devoid of black pigment, having much brownish as a rule. In regard to the cotypes of *aethiops*, it is also found that the femora are both spotted and reticulated with white, so the pattern of the hind legs is not particularly different from that usually found in *tessellatus*. The presence of six stripes instead of four is not unusual. It has already been pointed out that a specimen from Thompson, Utah (C.A.S. No. 38163), has been found with as high as eleven stripes and that an increase from the usual four stripes is not at all uncommon in certain areas. Therefore, the presence of six stripes scarcely indicates relationship with *perplexus*, which differs decidedly from the types of *aethiops* in that the ventral parts are white instead of black.

In the original description of *aethiops* it was also stated that "A form very much like this has been named *martyris* by Stejneger. The two known specimens differ from *melanostethus* in their smaller size and in the extension of the black over the entire inferior surface. It is doubtful whether it can be regarded as a subspecies." It may be remarked that *martyris* is much closer to the specimens from Parras and Lerdo that have been discussed as *variolosus* than to the geographically adjacent *aethiops*, since it has lost practically all indications of longitudinal arrangement in the dorsal markings and the markings themselves are extremely fine. It will be remembered that *aethiops* has, characteristically, six stripes. With the accumulation of additional specimens it has been found that the extension of black over the entire ventral surface occurs in certain "*melanostethus*" from the United States, so this point is not important here. Therefore, Gadow's listing of *aethiops* as a synonym of *martypis* (1906, p. 373) was evidently a misconception.

Because of the failure of the diagnosis of *aethiops* and because of its obvious similarity to northern specimens of *tessellatus*, the name is here placed as a synonym of the latter. This agrees with the conclusion reached by Van Denburgh (1922, p. 529).

In 1919, Dickerson described two new species of *Cnemidophori* from Tiburon Island, Gulf of California, namely, *punctilinealis* and *disparilis*. The appearance of these two closely related forms on one small island was surprising, but two, as such, have been recognized until the present time.

The original description of *punctilinealis* is lengthy and detailed. The supposed differences from *melanostethus* (=*tessellatus*) are as follows: The attainment of advanced stages of color pattern at an earlier period of development, and the possession of a different color pattern on the sides, a longer head, and a longer foot. The paratypes of *punctilinealis* are not uniform in their characters, the dorsal coloration in some approaching that of typical *rubidus*. This point will be discussed under that form. It is not exactly understood why these specimens should have been considered as attaining advanced stages at an early period of pattern development, and in the pattern itself there is nothing distinctive. Moreover, the length of the head and of the foot have found to be worthless as diagnostic characters. Some of the paratypes have the chest covered with a deep black suffusion and in others this suffusion is only light slate. Schmidt (1922, p. 676) in discussing these specimens stated that "The species, *punctilinealis*, apparently represents a fairly distinct race of *melanostethus*, the dorsal coloration being more nearly that of *tessellatus*, the ventral of *melanostethus*. This is exactly the coloration described by Van Denburgh and Slevin in specimens from Isla Partida, near Angel de la Guardia Island, as *dickersonae;* a paratype of this species, in the collection of the American Museum of Natural History, is more clearly allied in color pattern to adult *disparilis*." It is evident from Schmidt's discussion that he was confused about the affinity and significance of this form. Van Denburgh (1922, p. 529) showed that he realized the futility of giving it recognition by placing it in the synonymy of *melanostethus*. Because of the lack of reliable diagnostic characters in *punctilinealis*, this author is followed in considering the species as not even a "fairly distinct race of *tessellatus*."

The original description of *disparilis* (based on a type and two paratypes) is largely indefinite. The following differences from *martyris* are cited: locality, spotted coloration, presence of enlarged scales under the forearm, and variation in measurements. It appears from the description that the "form" is a composite, drawn from more than one species. Van Denburgh (1922, p. 497) studied this problem as follows: "The original description of the young (the two paratypes) indicates that they do not represent the same species as the adult type specimen. Careful comparison of the paratypes with a series of *catalinensis* has shown them to be identical. It, therefore, became doubtful whether Miss Dickerson's specimens really came from Tiburon Island. In response to my request for information, Mr. Karl P. Schmidt has kindly written: 'On looking up the data in the department catalogue, I find numbers 6884–5 labeled "Lower California, received January 3, 1912, N. Y. Z. S." It is therefore not improbable that the two juveniles were really collected on Santa Catalina Island and sent to the American Museum separately from the park of the New York Zoological Society.' I have had no opportunity to examine the type specimen from Tiburon, and therefore introduce the species *disparilis* here, although I am of the opinion that it may be founded upon a specimen of *melanostethus* with abnormally large scales on the back of the forearm."

After an examination of all of the types concerned the writer fully agrees with Doctor Van Denburgh, but finds that the postantebrachials, although slightly enlarged, are rather typical in form. The paratypes mentioned are certainly *catalinensis* (as discussed under that form, see p. 213) and the type is typical of *melanostethus* of the region, having very probably come from Tiburon Island as indicated. The coloration of the type shows a development of the tendency to increase the number of dorsal lines as discussed above. Anteriorly there are six lines, indicating that the form is derived from six to eight striped young, and posteriorly the dark field spots have secondarily become longitudinally confluent so as to double the number of lines along the back. These lines are all narrow, poorly defined, and more or less reticulated, especially laterally. To the extreme posterior end of the back the tendency to become unicolor is evident, and the femora are obscurely spotted, almost monochrome. Below, the throat is smoky and with several dark, transverse bars, while the chest is uniform smoky black. It is obvious that part of the type description came from this individual and comparison of data shows that the measurements given for the type are approximately correct.

Thus, *disparilis* is a synonym of *melanostethus* (=*tessellatus*). In further support of this action it may be remarked that a series of specimens in the California Academy of Sciences, definitely known to be from Tiburon Island, are all *tessellatus*. Data on these specimens are given below under variation.

Still another species, *estebanensis*, was described by Dickerson. This form is from San Esteban Island, which lies very close to Tiburon. It was said to be closely allied to both *melanostethus* and *punctilinealis* and differences in the proportions of the body were cited in the diagnosis to distinguish it from these two forms. The writer has found that the bodily proportions are remarkably uniform throughout the *tessellatus* group, if not throughout the entire genus, and so it is not possible to use them to separate closely related species or subspecies from each other. Therefore, such points as "longer foot, longer head, and smaller size," may be passed over with little discussion. As said by Schmidt (1922, p. 675), "The differences cited in the original description to distinguish *estebanensis* from *melanostethus* are inadequate and I am unable to find other characters of greater weight. The coloration seems to be practically identical." The type itself shows the usual four lines of *tessellatus*, and the pattern is largely longitudinal, since the spots and reticulations do not tend to unite transversely as in *martyris* and *canus*.

A series of 17 specimens of *tessellatus* from San Esteban Island in the collection of the California Academy of Sciences lends weight to the decision that *estebanensis* is identical with *melanostethus* (= *tessellatus*), the form on Tiburon Island and the adjacent Mexican mainland. The ventral color of these varies from white below in the young to deep black below in the adults.

A new species, *dickersonae*, was diagnosed by Van Denburgh and Slevin (1921, p. 97) from Isla Partida, near Angel de la Guardia Island, Gulf of California. This form was said to be intermediate between *stejnegeri* and *melanostethus* in coloration, possessing the yellowish brown dorsal ground color of *stejnegeri* and the black gular and thoracic suffusion of *melanostethus*, but the dorsal longitudinal markings were duller than in either *stejnegeri* or *melanostethus*. The sides were dark brown or black and with whitish transverse bars or spots as in *estebanensis*, but the pattern was presumed to be different from *estebanensis*.

Schmidt (1922, p. 676) drew attention to the fact that the coloration described by Van Denburgh and Slevin for their new species (*dickersonae*) was exactly the same as that of Dickerson's *punctilinealis*. And Van Denburgh (1922, p. 513) in discussing *tessellatus* admitted that a specimen from Smith Island was possibly that species (*tessellatus*), although the coloration was "not typical" and he regarded it as *dickersonae*. Disregarding this, the specimen seems to be as near to *canus* as to *tessellatus*, varying from the former only in its somewhat coarser dorsal reticulations. In other words, the Smith Island specimen is intermediate between *canus* and *tessellatus*, as here defined.

Just why Van Denburgh and Slevin should have regarded *dickersonae* as intermediate between *stejnegeri*, the dark-backed form of the higher levels, and *melanostethus*, the brownish form of the open deserts, is not apparent. It really seems to be nearer the extreme development of the *melanostethus* phase than to anything else, since the under parts are black in adults, and since the dorsal pattern is light brownish and presents few sharp contrasts. A yellowish brown dorsal ground color *may* appear in "*stejnegeri*" as well as in any other population of *tessellatus*, but it does not occur in what has been presumed to be typical *stejnegeri*. It is true that the pattern of *dickersonae* resembles that of *estebanensis* on the sides, as in most other features, the chief exception being in a somewhat further development of the tendency to increase the number of dorsal lines. This is only relative, however, and has little diagnostic value. In both *dickersonae* and *estebanensis* the pattern tends to become obsolete posteriorly first. Since it is obviously impossible to define *dickersonae*, it is here made a synonym of *tessellatus*.

The forms of the higher levels to be discussed under the *second section* outlined above (p. 155) are as follows: *grahamii*, *undulatus*, *multiscutatus*, *stejnegeri*, *mundus*, and *bartolomas*.

The first of these, *grahamii*, was described by Baird and Girard in 1852, with *gracilis*, *marmoratus*, and *tigris*. The latter forms have already been discussed, but *grahamii*, which comes from Texas, has been referred to this section because it is like the Californian *stejnegeri* with which it may best be compared.

In the original description, *grahamii* was separated only from *tigris* and *marmoratus*. It is differed from both in certain proportional features which are obviously of little diagnostic value, such as "width of head and size of cephalic plates." Also, in having larger collar (mesoptychial) scales. The latter character presents an average variation from the desert representatives of *tessellatus*, but it is not constant and, what renders it less useful in this diagnosis, is the fact that it also frequently appears in western specimens from the rougher areas. Therefore, it is valueless here.

From the original description and from subsequent reports, it has become evident that *grahamii* is to be regarded as a dark phase of the tessellated lizard—not unlike *stejnegeri* of the west coast. It was said by Strecker (1915, p. 25) that "Unlike the young of *tessellatus*, which are striped, the young of this species have the color pattern of the adult." But, the same authority (1910, pp. 11–12) had already written that the young are as follows: "Black above, with a median dorsal zigzag light line, buff in color. On each side of this are four buff stripes, the lower one in each case being much broken and rather indistinct. Small buff spots in the black interspaces indicate the approach of the adult type of coloration." It is the opinion of the writer that the young are almost always striped, but that frequently the adults may lose the longitudinal arrangement of the dorsal markings, more or less completely. The types themselves show indications of stripes, and the completely tessellated or cross-barred phase is comparatively rare in most localities. Because of the decidedly marked tendency for *grahamii* to develop tiger bars, Cope (1892*c*, p. 42) considered the form as a "distinct species which resembles the partly cross-banded examples of *tessellatus* in coloration." These partly cross-banded forms of *tessellatus* have been noted to be particularly common in certain collections from Utah.

Perhaps the strongest argument for uniting *grahamii* of Texas and *stejnegeri* of the west coast with the intervening form in the Great Basin is the demonstration of their similarities. It has already been emphasized that they occupy similar habitatas which correspond with the higher levels[21] tolerated by these lizards and that a single structural modification, a tendency toward the enlargement of the mesoptychial scales, is found in both. It has also been shown that they develop a dark dorsal coloration and that the ventral parts tend to have a white ground color which is devoid of smoky suffusion.

It is little wonder that Cope (1900) was lead to refer to *stejnegeri* as a subsepecies of *grahamii*, or that various workers reported *grahamii* from the west coast before and even after *stejnegeri* was described, among them Bocourt (1874, p. 278), Mocquard (1899) and Ditmars (1907, p. 187).

In 1854 *undulatus* was described from California by Hallowell. An examination of the type shows that it had a few black spots on the gular region and that the dorsal fields are dark, tending to be rather confluent longitudinally, although often broken through by white crossbars. As in specimens of *tessellatus* from the Great Basin, the tessellation is more pronounced on the sides than on the back where the dorsal interspaces often have spots which have not spread to form crossbars or lines.

The following statements taken from Stejneger (1893, p. 200) give an excellent analysis of the variation exhibited by these lizards in the region of Death Valley: "Ten specimens from the west slope of the Sierra Nevada differ so much from the desert specimens that I must regard them as entitled to a separate trinomial appelation. So far as I can see there is no structural difference, nor is there a very radical difference in the color of the pattern. The latter is considerably coarser, better defined and deeper in color. The difference between the two forms in this respect is particularly well marked on the sides of the head, the darker marks being nearly obsolete in the desert form, while in the latter the slate colored suffusion on the under side seems to the rule. I have yet to see a specimen from the great interior valley of California in which it is present.

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[21] In this connection it is interesting to note that Bailey (1913) assigned *grahamii* to the upper Sonoran Zone of New Mexico, whereas he assigned both *melanostethus* and *tigris* to the Lower Sonoran Zone.

"As to the name of the form, I have to remark that the specimens have been carefully compared and found identical with Hallowell's type specimens. It will be observed that in the original description of *undulatus* the locality of the type is stated to be 'near Fort Yuma in the San Joaquin Valley,' but the self-contradiction of this statement is explained by the fact that Fort Miller, Fresno County, is meant, and not Fort Yuma, on the Colorado River."

Thus, it is seen that *undulatus* is the foothill phrase of *tessellatus* in the west and that it is correspondingly darker above than the desert type. At this point it seems logical to introduce still another form, *stejnegeri*, which has been found to be but an intensification or further development of *undulatus*.

Van Denburgh described *stejnegeri* in 1894 from a series of thirteen specimens taken along the west coast of the northern district of Lower California. He said that "*Cnemidophori* from northern Lower California and from San Diego County, California, present much the general appearance of *C. tigris undulatus* (Hallowell). They differ from that form in having the dorsal scales smaller, the gular scales and the scales on the collar larger, and in the presence of large and well-defined black spots on the gular region. From *C. tigris* Baird and Girard they differ by the character of the scales as above indicated, by the absence of the slate-colored suffusion on the gular region, and by the well-defined black markings on the sides of the head.

"As shown by Doctor Stejneger, *C. tigris* is the desert form found in eastern California as far south as the Mohave Desert, in southern Idaho, in Nevada, and in Utah. *C. tigris undulatus* inhabits the western slopes of the Sierras, and is also found on the western side of the interior valley of California as shown by specimens in Stanford University from Kelseyville, in Lake County, and from Los Gatos, Santa Clara County."

When series are studied, it becomes obvious that the distinctions between *stejnegeri* and *undulatus* based on the dorsal granules and the gular and mesoptychial scutellation are highly variable and hence worthless. These same characters do not offer a separation from the specimens of the Great Basin which have been mentioned above as *tigris*, so this confines our discussion largely to facts concerning the coloration.

The differences between *undulatus* and *stejnegeri*, as outlined by Van Denburgh, were summarized in a key by McLain (1899*b*, p. 9) as follows:

Spots on throat few and small; central gular and collar scales larger.
C. t. undulatus

Spots on throat numerous and large, often forming irregular transverse bands; gular and collar scales larger________________________**C. t. stejnegeri.**

The critical notes given below this key seem worthy of quotation since they agree with what the writer has found after an examination of the same collection (Stanford University).

"Seven specimens from Carmel Valley, Monterey County, California, are all distinctly of the *stejnegeri* type, except one (3397), which is young and in which the spots are few and small. This great extension of the range led me to examine the others in the collection.

"A jar of specimens from Ontario, California, contains four (3409, 3407, 3408, 3405) typical *undulatus*, one (3411) typical *stejnegeri*, while four (3406, 3410, 3412, 3414) are intermediate, although they are nearer *undulatus* than the other form.

"Mr. Heller obtained typical *stejnegeri* at Warren's Well and Lytle Creek, San Bernardino Mountains, San Bernardino County, and Cuyamaca Mountains, San Diego County, California, while he took typical *undulatus* at Lytle Creek, San Bernardino County, and a small intermediate specimen from Riverside, California.

"Mr. Coolidge took typical *undulatus* at Grapeland, altitude about 2,000 feet, three miles west of San Bernardino, near Cajon Wash, San Bernardino County, and another from the same locality, with but a very few spots, and a third one from southern California, from which unfortunately the tag has been lost.

"The occurence of the white-throated form in the south and the spotted-throated form in the north indicates that *stejnegeri* is but a synonym of *undulatus*. We feel certain that future specimens will add to our proof and confirm this beyond a doubt.

"Indeed the variation of the spots on the sides of the head seen in the northern specimens even lead one to suspicion the validity of *C. t. undulatus* as a good subspecies. But the almost total absence of specimens in the collection from the range of *C. tigris* prevents this matter being looked into more thoroughly at present."

Thus it is seen that as early as 1899, five years after the description of *stejnegeri*, serious doubt was cast upon the validity of that form, and at the same time the distinctness of *undulatus* from *tigris* (=*tessellatus*) of the Great Basin was openly questioned. If McLain had examined two specimens from Santa Rosalia, Chihuahua (U.S.N.M. Nos. 47404–47405), he would no doubt have been still further perplexed. Both of these are light below and while one shows the gular spots and scutellation of *stejnegeri*, the other shows the whiter throat and smaller scales of *undulatus*.

It seems important that Cope (1900, p. 600) wrote that *stejnegeri* does not seem to be very different from *C. grahamii grahamii*. The likeness was held to be so great that, in spite of lack of proof of intergradation in the extensive area between the two populations, *stejnegeri* was listed as a subspecies of *grahamii* and not of *tessellatus*, which is actually the intervening form. The species, *stejnegeri*, fared even worse at the hands of Gadow (1906, p. 369), for he considered it a synonym of *tessellatus*.

In connection with her studies of Californian specimens, Atsatt (1913, p. 39) examined the series of whiptails in the collection of the Museum of Vertebrate Zoölogy of the University of California. (These same specimens have been examined by the writer.) Her conclusions were as follows: "One of the distinctions between *tigris* and *stejnegeri* is based on scalation, on the relative size of the central gular and collar scales. Since these appear to vary with age, comparison has to be made with specimens accurately agreeing in size and there is no structural criterion of age or relative development. Under such circumstances within any given group of material of either species one finds variation in relative proportions—such wide variation as to make the specific determinations extremely difficult. The other distinction is based on the gray suffusion and the clearness of the pattern on the sides of the head, neck and gular region. *C. tigris* from Nevada in the Museum collection presents both distinct and indistinct markings on the sides of the head, while the specimens from Mecca, California, have distinct markings and those from the Colorado River have generally indistinct markings. * * * On a general survey of masses of material one feels that the effect of the environment upon the individual has been great."

Thus, once again not only a demonstration of the weakness of the distinctions, but also a suggestion of the environmental nature of the differences between these lizards, was brought out. The futility of recognizing them as distinct species was realized by Camp (1916, p. 71) who wrote that "The difficulty of separating *tigris* and *stejnegeri* comes from the fact that *stejnegeri* on the desert borders of its range gradually takes on the dusky suffusion of *tigris*, and that many examples of *tigris*, even from the interior desert regions, have fully as large central gular scales as the majority of *stejnegeri*.

"Because of the practical impossibility of separating *tigris* and *stejnegeri* at certain points on the desert divides and farther east in southern California, the writer believes that the forms in question had best be placed together as subspecies."

In this way *stejnegeri* was again reduced to subspecific rank, from whence it had been removed by Van Denburgh, its describer.

The whiptails under discussion as *undulatus* were, on account of preoccupation by *C. undulatus* Wiegmann (1834), given the name "*mundus*" by Camp (1916*a*, p. 71), who found that they were very hard to separate from *tigris* and *stejnegeri*. Therefore, *mundus* was made a subspecies of *tigris*.

Van Denburgh (1922, p. 492) admitted that the throat of *stejnegeri* is sometimes slightly suffused with gray or slate, and in the discussion of *mundus*, he stated that the central gular and collar scales were a *little* smaller than those of *stejnegeri* and that the small, smooth, convex granules on the back were *usually slightly* larger than in that form.

After the examination of hundreds of specimens of *tessellatus* from the west, it seems remarkable to the writer that *stejnegeri* and *mundus* should have remained as distinct forms up to the present time. The amount of spotting on the throat not only varies with age and individuals, but probably with sex as well. The specimens with the most concentration of black on the throats and at the sides of the head are usually old males. The individual variation is so great in most regions that it is almost certain that in a large series both *mundus* and *stejnegeri* can be easily found. An attempt to confine this " intergradation " proved so futile during the early part of this study that it was abandoned. The great overlap in colorational features and the failure of the distinctions based on scalation (as indicated above) render *mundus* a synonym of *stejnegeri*.

It seems worth while to discuss the variation found in a series of 94 specimens (from many localities) in the collection of the California Academy of Sciences that was labeled "*stejnegeri*" by Van Denburgh. It was found that the coloration of the breast, abdominal region, under parts of the tail, throat and sides of the head, varied greatly. In the majority of the specimens the blackness of the breast, gular region, and sides of the head is confined to small areas (scattered spots or patches) of intense black. In only a minority of specimens is the truly supposed condition of *stejnegeri* reached. In these the black concentrations are large and prominent, and the breast, throat and sides of the head are well marked with contrasting black and white. In some, the abdomen and under surfaces of the hind limbs are covered by black concentrations which fade to slate in other specimens. These markings are always somewhat lighter in shade than those anteriorly. Very few of the specimens are striped, although some trace of longitudinal arrangement of the dorsal markings is nearly always present. A specimen was found with only vestiges of stripes (C.A.S. No. 40276).

The practical impossibility of separating *stejnegeri* and *tigris* (= *tessellatus*) has already been discussed. That there is a transition from a brownish to a blackish dorsal color pattern when whiptails leave the desert is not denied, but the fact that this transition is general, rather than local, has been pointed out. Thus, from the standpoint of their characteristics, certain specimens representing the *grahamii* of Texas, the *tessellatus* of Chihuahua, and the *stejnegeri* of the west coast are the same, and examples not unlike these have been found almost everywhere at the edges of the Great Basin and even in the basin itself where there are mountains. Because of the uniformity of the change in *tessellatus*, the continuous range, and the general possession of the more fundamental (constant) characters, upon which a valid taxonomic appellation should always rest, *stejnegeri* and *tessellatus* are here recognized as one.

The whiptails on Cerros Island were described as *C. tessellatus multiscutatus* by Cope (1892*c*, p. 38), who stated that the coloration was of the *tessellatus* type, but that the black ground color was more persistent. The tail was said to be black spotted below. Van Denburgh elevated the form to full specific rank in 1895 and continued to recognize it as a distinct species in his later works. In 1922 he wrote of it as follows: "I am unable to find the differences which Cope stated to exist between this lizard and other members of the *tessellatus* group. The nine specimens from Cerros at hand seem to be more like *stejnegeri* than like any other race, although they sometimes have the ashy suffusion of the gular region seen in *tessellatus*. The large, well defined black markings on the sides of the head and neck and on the gular region are similar to those of *stejnegeri*. The marking on the lower surface of the tail, however, is quite different. Each of the scales of the inferior central rows has a large central black spot. No such regular or abundant spotting is seen in this region in *stejnegeri*. Twenty-three specimens from Natividad Island agree with those from Cerros, but the black markings on the lower surface of the tail are not quite so regularly distributed, and those on the gular region are larger and more frequently form cross-bars." An examination of the material seen by Van Denburgh shows that the coloration is largely intermediate between that of the desert and upland phases for the indications of both are seen. The ventral parts vary in color from white to slate, and the markings on the throat vary from a total absence to a prominent reticulation or cross-barring of the region. There is nothing unusual or diagnostic in the dorsal coloration, except that it tends to be duller than that of certain specimens on the adjacent mainland.

Usually the supposedly diagnostic subcaudal spots are on most of the scales, but at times they are faint or partly absent. The occurence of these spots is very common in *tessellatus*, particularly from the northern part of the great interior basin of the west. This fact was noted by Cope as early as 1900, at which time he wrote as follows: "I took a specimen which differs in no respect from *multiscutatus* on the road between Reno and Pyramid Lake in western Nevada." In spite of Van Denburgh's elevation of *multiscutatus* to a full species, Gadow (1906, p. 370) wrote that "This lizard can scarcely claim distinctive rank," and he added that "a specimen obtained by Doctor Meek at El Paso fits exactly the *C. tessellatus multiscutatus.*"

It is evident that the character of the subcaudal spots is useless in this case. Although it may separate *multiscutatus* from the specimens of *tessellatus* on the adjacent mainland hitherto designated as *stejnegeri*, it does not diagnose them from those of the Great Basin. Therefore, because of the failure of the one supposedly diagnostic character, it is necessary to regard *multiscutatus* as but another synonym of *tessellatus.*

A new species, *bartolomas*, was described by Dickerson (1919, p. 476) on the basis of four specimens from the general region of San Bartolome Bay, which is near the southern extreme of the range of *tessellatus* on the mainland of Lower California. The original description of *bartolomas* is indefinite and no diagnosis is given. Schmidt (1922, p. 673) wrote that "The four specimens of this form brought back by the Albatross expedition are of considerable interest for the variations they exhibit. In two specimens, the (anterior) nasal is in contact with the second (upper) labial on one side and separated from it on the other; in one case, just touching; in the other, more broadly in contact. In two specimens, there are only two complete rows of enlarged antebrachials; in the others, there are three complete rows. In coloration, one specimen A.M.N.H. No. 5522) from the more southern locality, Abrejos Point, Ballenas Bay, approaches *rubidus* in the distinctness and wide separation of the black spots. The remaining three are fully adult specimens, the spots somewhat smaller and less sharply defined.

"In the variation of the antebrachials and the second labial, these specimens show an approach to *labialis*, which is amply distinguished, however, by other characters * * * I believe that *bartolomas* is directly related to *stejnegeri*, and that it is derived from that form. It seems amply distinct in the character of the throat scales described in the key. *C. multiscutatus* is somewhat less distinct from *stejnegeri* in coloration and in other characters than *bartolomas.*" The scale characters mentioned refer to the possession of "Granular scales between the collar and the large central gulars, which are very small and abruptly differentiated from the latter." This character is unreliable, as may be seen by the examination of almost any series in which a number of ages or geographical localities are represented. The possession of small, and somewhat variable, posterior gulars is characteristic of the whole genus *Cnemidophorus*, being particularly so of those individuals living in sandy areas, and is generally unreliable for separating even distantly related species from each other.

According to Slevin (1926, p. 205) "Two specimens (C.A.S. Nos. 59558–59559) were collected at San Bartolome Bay on June 2, 1925.

Neither of these specimens agrees with the description of the type in dorsal coloration, showing none of the alternating of the spots in the dorsal rows. Van Denburgh was doubtful of the distinctness of this species from *rubidus*. Of the specimens before me the dorsal coloration of one resembles *stejnegeri* while that of the other resembles *rubidus*. The gular region of the former shows less of the black markings characteristic of *stejnegeri*, while the latter has the black throat found in specimens of *rubidus* from Magdalena Island. More material and future study may prove this species to be an intergrade between *rubidus* and *stejnegeri*."

An examination of the types discussed by Schmidt and the two additional specimens mentioned by Slevin indicates that all are *tessellatus*, for none of them have reddish or pink tails (the most outstanding characteristic of *rubidus*). The dorsal color pattern is in most cases typical, but in the two specimens mentioned in the above discussion, there is a decided tendency to approach that of *rubidus*, just as one might expect from their geographical position. Therefore, more perfect intergrades between *rubidus* and *tessellatus* may be expected from a point south of Ballenas Bay when more specimens are collected.

Diagnosis.—The desert whiptail may be distinguished from other *Cnemidophori* as follows: Supraoculars normally 4; frontoparietal plates normally 2; postantebrachials small or only slightly enlarged, never scutelike; under surfaces of tail and feet without red or pinkish; ventral suffusion or spotting, if present, blackish and not bluish as in *gularis;* sides of body never completely striped; lateral crossbars, spots, or reticulations present; dorsal pattern usually with at least some indications of longitudinal arrangement, if without these, a network of rather coarse reticulations present.

This subspecies is most apt to be confused with *martyris* and *canus*, from which it may be separated at times only with difficulty. As a rule it is larger than these forms and it always has relatively coarser dorsal markings.

Description.—Snout usually rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars 3–5, normally 4; position of supraocular granules variable; frontoparietals normally 2; parietals usually 3; occipitals small; anterior gulars moderate, uniform or somewhat enlarged centrally; posterior gulars smaller, more or less uniform, and sometimes not abruptly separated from anterior gulars; mesoptychial scales variable, but usually smaller at edge.

Body elongate; ventral plates in 8 longitudinal and 26–39 transverse rows; dorsal granules small to moderate, variable; limbs well developed; brachials 4–9; antebrachials 2–5; brachials and antebrachials more or less continuous at a point of contact; postantebrachium with small of slightly enlarged granules; femorals 5–11; tibials 2–5; femoral pores 15–25. Tail elongate, tapering; caudal plates large, oblique, and with rather strong longitudinal keels laterally.

Coloration highly variable; throat, white to deep black, spotted or unspotted, with or without tiger bars, never suffused with red or pinkish; breast, white to deep black, spotted or unspotted, rarely with a light bluish suffusion, sometimes mottled black and white; abdomen sometimes white in distinct contrast to a black chest, sometimes white like chest, and sometimes black like chest, spotted or unspotted; under surface of feet and tail not suffused with red or pinkish as in *rubidus*, but white, slate, yellowish, brown, dusky, or black; subcaudal dark spots present or absent; sides and dorsal surface of tail usually with some dark markings and reticulations, or washed with a chocolate or black suffusion; femora unspotted, reticulated, or spotted, sometimes unicolor; sides never with complete stripes, but with tessellations, crossbars, or spots; back often with four more or less wavy or broken dorsal lines, but sometimes as high as twelve are present; dorsal pattern, thus, usually with at least some indications of longitudinal arrangement; or, with coarse reticulations; ground color of back variable, light brown to black; dark and light in pattern sharply contrasted or not; in forms with black throats and chests, often a black scapular suffusion from below.

Variation.—There is much geographical variation in the coloration of *tessellatus*. Specimens from the lower levels, particularly from deserts, tend to become brownish above and black below, while those from the higher, more mountainous districts tend to become black above in ground color, and white below. In the former phase the dorsal pattern is poorly defined, but it is well defined in the latter. The subject introduced here is amplified above in the systematic notes, particularly on pages 154–157, and 166.

The general scutellational and proportional features seem to be everywhere relatively constant or relatively variable. This will be evident from an examination of the two tables presented herewith.

The first table presents the measurements, proportions and number of femoral pores of representative series of mainland specimens of the tessellated lizard. The Arizonan specimens are from Maricopa and Pima counties only and represent the "*melanostethus*" phase at its place of maximum development. The Californian examples represent "*stejnegeri* and *mundus*," and the Texas ones, "*grahamii*." It will be evident that the bodily proportions (which offer the only real basis of comparison for specimens of all ages) as well as the measurements and the numbers of femoral pores, show little variation. This indicates that these scattered populations are structurally almost identical.

Table showing the variation in measurements and in the number of femoral pores for mainland specimens of C. tessellatus tessellatus

Measurement (mm., etc.)	California and Lower California	Utah	Nevada	Texas	Arizona
Specimens used	72	100	50	22	72
Body	52–102	46–91	44–95	61–95	40–88
Tail	118–263	101–228	106–231	112–220	100–225
Total length	173–358	165–314	150–326	173–306	140–305
Width of head	8. 5–15	7. 5–15	7–13	8–13	8–13. 5
Hind leg	36–69	32–62	29–64	45–66	26–60
Length of tail as percentage of total length	68–73. 5	58–77	65–79	64–73	69–74. 6
Width of head as percentage of body length	12–16. 7	11. 3–17. 1	11. 2–16	11. 5–16	12. 1–16. 7
Hind leg as percentage of body length	61. 2–76	58–77	64–77. 5	64–77	64–79. 2
Femoral pores	16–24	18–24	17–25	18–23	17–24

The second table presents the measurements, proportions and numbers of femoral pores of representative series from the islands adjacent to Lower California. Specimens from Tiburon have been described as "*disparilis* and *punctilinealis*," those from San Esteban as "*estebanensis*," those from Isla Partida and Angel de la Guardia as "*dickersonae*," and those from Cerros and Natividad as "*multiscutatus*." It is evident that these figures show no significant differences from island to island nor between any islands and the mainland localities in the first table. It is perhaps worth pointing out here that these figures fail to support Richardson's "discovery" (1915) that there is a decrease in tail length and number of femoral pores in the more northern forms of widely ranging species of lizards (such as *tessellatus*).

Table showing the variation in measurements and in the number of femoral pores for island specimens of C. tessellatus tessellatus

Measurement (mm., etc.)	Tiburon	San Esteban	I. Partida Ang. de la Guardia	Smith	Cerros Natividad
Specimens used	35	18	60	1	84
Body	37–95	52–78	58–94	44	40–93
Tail	96–268	137–223	150–264	114	166–264
Total length	133–361	192–298	213–350	158	231–356
Width of head	9. 5–14. 5	8–12	8–14	6	7–14. 5
Hind leg	26–68	36–53	40–60	30	27–65
Tail as percentage of total	1. 68–77. 5	71–76	69–76	72	69–75. 4
Width of head as percentage of body length	12. 6–16. 7	13. 3–17. 3	12. 5–16. 3	13. 6	12. 3–17. 5
Hind leg as percentage of body	1. 62–79. 5	58–75	62. 8–76	68	67. 5–78
Femoral pores	17–25	16–22	17–23	17–20	15–23

The variation in the frontoparietals, supraoculars, and supraocular granules has been studied on a general series of 496 specimens, consisting of the examples used for the above tables with the exception of those listed from San Esteban Island. Since geographical variation is not evident, it does not seem necessary to present these data by localities.

The frontoparietal was found to be single in 2 specimens, double in 418 specimens, in 3 pieces in 33 specimens, in 4 pieces in 20 specimens, in 5 pieces in 17 specimens, in 6 pieces in 5 specimens, and in 7 pieces in 1 specimen.

The supraoculars were found to be 3 in 2 specimens, 4 in 437 specimens, 5 in 56 specimens, and 6 in 1 specimen; and the supraocular granules extended to the anterior border of the fourth supraocular in 2 specimens, to the middle of the third supraocular in 437 specimens, to the anterior border of the third supraocular in 43 specimens, to the middle of the second supraocular in 6 specimens, and to the anterior border of the second supraocular in 8 specimens. The forward extent of the supraocular granules is usually to the middle of the third supraocular as indicated here, but it is usually at the posterior border of the third supraocular in the United States specimens of *gularis* and *perplexus*.

The preanals are highly variable in number, so much so in fact that little attempt has been made to take data concerning them in any species of *Cnemidophorus*. Fourteen specimens of *tessellatus* from Cerros Island were examined for this character and the number was found to be 3 in 1 specimen, 4 in 7 specimens, 5 in 1 specimen, 6 in 2 specimens, 7 in 1 specimen, 8 in 1 specimen, and 9 in 1 specimen.

A large number of abnormalities in the arrangement of the head plates have been noted, but only some of the most conspicuous and probably most important are given here. A specimen (C.A.S. No. 40248) was found in which the frontal was divided by a transverse suture so as to leave a posterior frontal as large as the area occupied by the frontoparietals. (This variation occurs regularly in certain other teiids, such as *Ameiva bifrontata bifrontata*, *Ameiva bifrontata concolor*, and *Ameiva bifrontata divisa* of northern and northwestern South America.) In C.A.S. No. 17368 the right frontoparietal is united with the frontal. The same variation is seen in C.A.S. No. 37683, which also has a small median plate at the base of the frontoparietals. This latter abnormality is of rather frequent occurrence in *Cnemidophorus*, but in spite of this Barbour (1928) has mentioned it as a diagnostic feature of his *C. lemniscatus ruatanus*, which is represented by only the type specimen. Many specimens have been examined which show the progressive union of the two frontoparietals into a single scute. These are not confined to any one locality and may unite from either in front or behind. The finding of specimens of *tessellatus* with a single frontoparietal plate seems to have a bearing on the origin of *ceralbensis*, the only form in the *tessellatus* group which regularly possesses but one frontoparietal, as discussed under that species. Some of the examples with one frontoparietal, complete or incomplete, are as follows: C.A.S. Nos. 42473, 42447, 42459, 34580, 34596, 1574, 43223; Stanford Nos. 1026, 5706; and M.V.Z.U.C. No. 42670. In C.A.S. No. 48601 the right parietal is united with the interparietal and in C.A.S. No. 42657 the frontoparietals are distinct, but each is united posteriorly with the interparietal. In M.V.Z.U.C. the three parietals are all fused into a single plate.

Range.—This lizard is distributed over an unusually large territory. It inhabits the lower levels of western North America from northwestern Oregon southeastward to the Panhandle of Texas, thence south to southern Coahuila and west to the Pacific Ocean. It is found throughout the central and northern districts of Lower California and also on a number of islands in the Gulf of California.

An unusually large number of records is available for *tessellatus*, especially in the United States. The reports for this area are given by states in alphabetical order, preceding a similar listing of the Mexican specimens.

ARIZONA.—Apache County (*Adamana*, U.S.N.M.) Cochise County (*Chiricahua Mts.*, Van Denburgh, 1922, p. 532; *Ruker Canyon in the Chiricahua Mts.*, Van Denburgh, 1922, p. 532, Stanford; *Fairbank*, Van Denburgh and Slevin, 1913, p. 408, C.A.S.; *Huachuca Mts.*, *Stejneger*, 1902, p. 151, A.M.N.H., Stanford). Coconino County (*Flagstaff*, U.S.N.M.; *Grand Canyon*, U.S.N.M.; *Lee's Ferry*, Van Denburgh, 1922, p. 512, U.S.N.M., B.Y.U.; *Painted Desert*, A.M. N.H.; *Tanner Tank*, U.S.N.M,; *Tuba*, A.M.N.H., B.Y.U.). Gila County (*Globe*, F.M.N.H.; *Rice*, U.S.N.M.; *Roosevelt*, Van Denburgh, 1922, p. 532. M.V.Z.U.C.) Graham County (Ash Creek, U.S.N.M.; *Graham Mts., southwest of Solomonsville*, U.S.N.M.; *Safford*, U.S.N.M.). Maricopa County (*Agua Caliente*, Van Denburgh and Slevin, 1913, p. 408, C.A.S.; *Cave Creek*, Van Denburgh and Slevin, 1913, p. 408, C.A.S.; *Chandler*, M.V.Z.U.C.; *Gila Bend*, U.S.N.M.; *Hassayampa*, U.S.N.M.; *12 miles west of Maricopa*, Burt, Mich.; *Paradise Valley*, Van Denburgh, 1922, p. 532, C.A.S.; *Phoenix*, Van Denburgh, 1922, p. 512, U.S.N.M.; *25 miles northeast of Phoenix*, Taylor; *Sentinel*, Stone, 1911, p. 231; *Tempe*, Van Denburgh, 1922, p. 532, U.S.N.M., M.V.Z.U.C., Stanford; *Vulture*, U.S.N.M.) Mohave County (*Colorado River above Bill Williams River*, M.V.Z.U.C.; *Colorado River at the mouth of Diamond Creek*, U.S.N.M.; *Fort Mohave*, Van Denburgh, 1922, p. 512, U.S.N.M.; *Hackberry*, U.S.N.M.; *Harper's Ferry*, U.S.N.M.; *13 miles north of Kingman*, Mich.; *Foot of the Needles along the Colorado River*, M.V.Z.U.C.; *Topock*, U.S.N.M.; *between Topock and Oatman*, Klauber). Navajo County (*Winslow*, F.M.N.H.). Pima County (*Ajo*, Van Denburgh

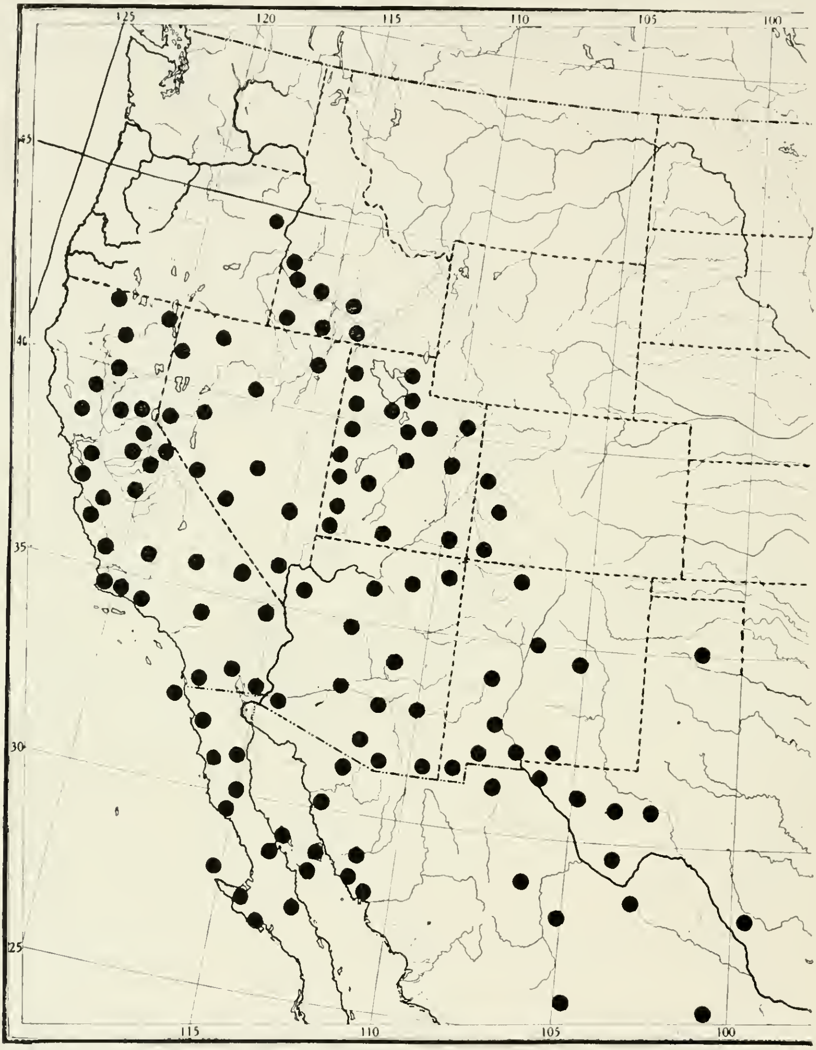

FIGURE 27.—MAP SHOWING LOCALITY RECORDS FOR CNEMIDOPHORUS TESSELLATUS TESSELLATUS (COUNTY REPORTS IN THE UNITED STATES)

and Slevin, 1913, p. 409, C.A.S.; *Fort Lowell*, U.S.N.M., C.A.S., Stanford, F.M.N.H.; *Bank of Pantano Wash east of Fort Lowell*, Ruthven, 1907, p. 563, A.M.N.H.; *Plains south of Fort Lowell*, Ruthven, 1907, p. 563, A.M.N.H.; *plains southwest of Fort Lowell*, Ruthven, 1907, p. 563, A.M.N.H.; *Greasewood Plain*, U.S.N.M.; *Gunsight*, Van Denburgh and Slevin, 1913, p. 408, U.S.N.M., C.A.S.; *Pima Canyon*, Ortenburger and Ortenburger, 1926, p. 111; *Roeble's ranch at Coyote Springs between Tucson and the Baboquivari Mts.*, Stone, 1911, p. 231, A.N.S.P.; *Soldier Canyon Camp*, Carnegie; *Sonora Road Canyon in the Tucson Mts.*, Stone, 1911 p. 230; *Tucson*, U.S.N.M., A.M.N.H., C.A.S., Mich., San Diego Soc. Nat. Hist.; *Campus of the University of Arizona at Tucson*, A.M.N.H.; *mesa west of the Santa Catalina Mts. near Tucson*, Ruthven, 1907, p. 563, C.A.S., A.M.N.H.; *mesa west of the Santa Cruz River at Tucson*, Ruthven, 1907, p. 563, A.M.N.H., Carnegie; *Oracle Road north of Tucson*, A.M.N.H.; *plains east of Tucson*, Ruthven, 1907, p. 563, A.M.N.H.; *plains northeast of Tucson*, Ruthven, 1907, p. 563, A.M.N.H.; *plains southeast of Tucson*, Ruthven, 1907, p. 563, A.M.N.N.; *Sabino Canyon, 15 miles northeast of Tucson*, A.M.N.M., Taylor; *near the Santa Cruz River at Tucson*, Ruthven, 1907, p. 563, A.M.N.H.; *east of Sawtooth Mountain.*, Carnegie; *near the Steam Pump, 18 miles north of Tucson*, Van Denburgh and Slevin, 1913, p. 408, Taylor). Pinal County (*1½ miles northwest of Casa Grande*, Burt, Mich.; *5 miles northwest of Casa Grande*, Burt, Mich.; *10 miles northwest of Casa Grande*, Burt, Mich.; *North of Tucson*, Carnegie; *South of Florence*, Carnegie; *5 miles southeast of Maricopa*, Burt, Mich.; *5 miles west of Maricopa*, Burt, Mich.; *16 miles west of Miami*, Taylor; *Superior*, Taylor). Santa Cruz County (*Fort Buchanan near Crittenden*, Yarrow, 1882, p. 43, U.S.N.M.; *Nogales*, Coues, 1887, p. 45). Yavapai County (*Camp Verde*, U.S.N.M.; *Congress Junction*, U.S.N.M.; *Kirkland*, U.S.N.M., A.M.N.H.; *Turkey Creek*, U.S.N.M.). Yuma County (*Buckskin Mts.*, M.C.Z.; *10 miles below Cibola near the Colorado River*, M.V.Z.U.C.; *east of Dome*, U.S.N.M.; *7 miles east of Dome*, Burt, Mich.; *Ehrenberg*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Gonzales Well*, M.V.Z.U.C.; *5 miles north of Laguna*, M.V.Z.U.C.; *11 miles east of Mohawk*, Burt Mich.; *Papago Wells*, Van Denburgh and Slevin, 1913, p. 409, C.A.S.; *Salome*, M.V.Z.U.C.; *Timajas*, U.S.N.M.; *Yuma*, Van Denburgh, 1912, p. 153, U.S.N.M., M.C.Z., C.A.S., F.M.N.H., Stanford; *Desert east of Yuma*, Taylor, U.S.N.M.; *9 miles east of Yuma*, Burt, Mich.; *15 miles east of Yuma*, Burt, Mich.)

CALIFORNIA.—Contra Costa County (*Mt. Diablo*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.). Eldorado County (*General Report*, Yarrow, 1882, p. 45, U.S.N.M.; *Limekiln, middle fork of the American River at 1,000 feet*, M.V.Z.U.C.). Fresno County (*1 mile south of Dunlap at 2,000 feet*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Fort Miller*, Van Denburgh, 1922, p. 518, U.S.N.M., A.N.S.P.; *Fresno*, Cope, 1900, p. 579, U.S.N.M., Stanford; *Fresno Flat*, U.S.N.M.; *Huron*, U.S.N.M.; *Mendota*, Van Denburgh, 1922,

p. 518, U.S.N.M.; *19 miles southwest of Mendota*, M.V.Z.U.C.). Glenn County (*Winslow*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.). Imperial County (*Calcixo*, Van Denburgh, 1922, p. 512, U.S.N.M.; *Colorado Desert*, Van Denburgh, 1922, p. 512, U.S.N.M., San Diego Soc. Nat. Hist.; *Colorado River, 8 miles below Picacho*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Coyote Wells*, U.S.N.M., M.V.Z.U.C.; *Fort Yuma*, Stanford; *5 miles northeast of Fort Yuma near the Colorado River*, M.V.Z.U.C.; *Gardener's Laguna, Salton River, Colorado Desert*, U.S.N.M.; *Imperial Valley at the Mexican Border*, Cowles, 1920, p. 65; *New River near Salton Lake*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Pilot Knob*, Van Denburgh, 1922, p. 512, M.V.Z.U.C., San Diego Soc. Nat. Hist.; *Pot Holes*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Salt Creek*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Salton Sink at 265 feet below sea level*. Cowles, 1920, p. 65).—Inyo County (*Argus Range*, Stejneger, 1893, p. 200, U.S.N.M.; *Ballarat*, Van Denburgh, 1922, p. 512, F.M.N.H.; *Beveridge Canyon*, Van Denburgh, 1922, p. 512, F.M.N.H.; *Big Pine*, Van Denburgh, 1922, p. 512; *Caroll Creek at 5,500 feet in the Sierra Nevada*, M.V.Z.U.C.; *Coso Mts., at Coso*, Stejneger, 1893, p. 200, U.S.N.M.; *Coso Valley*, Van Denburgh, 1922, p. 512, F.M.N.H.; *Darwin*, Van Denbergh, 1922, p. 512, M.V.Z.U.C.; *15 miles north of Darwin*, M.V.Z.U.C.; *Death Valley at Bennett Wells*, Stejneger, 1893, p. 200, U.S.N.M.; *Death Valley at Furnace Creek*, Stejneger, 1895, p. 200, U.S.N.M.; *Deep Spring Valley*, Stejneger, 1895, p. 200, U.S.N.M.; *Emigrant Canyon*, Van Denburgh, 1922, p. 512, M.V.Z.U.C., F.M.N.H.; *Furnace Creek Ranch in the Death Valley*, M.V.Z.U.C.; *Grape Vine Canyon*, Van Denburgh, 1922, p 512; *Grays at 6,000 feet near Kearsarge Pass*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Hanaupah Canyon in the Panamint Mts.*, M.V.Z.U.C.; *Independence*, M.V.Z.U.C.; *2 miles north of Independence*, M.V.Z.U.C.; *2½ miles east of Independence*, M.V.Z.U.C.; *Inyo Mts.*, Van Denburgh, 1922, p. 512; *Keeler*, Van Denburgh, 1922, p. 512, F.M.N.H.: *Laws*, M.V.Z.U.C.; *1 mile south of Lee Pump in the Panamint Mts. at 6,100 feet*, M.V.Z.U.C.; *Lone Pine*, Stejneger, 1893, p. 200, U.S.N.M., M.C.Z., F.M.N.H., Stanford; *Lone Pine Creek, 4 miles northwest of Lone Pine*, M.V.Z.U.C.; *Mazourka Canyon at 4,000 feet in the Inyo Mts.*, M.V.Z.U.C.; *Mesquite Valley*, Van Denburgh, 1922, p. 512, F.M.N.H.; *5 miles southwest of Olancha*, Cope, 1900, p. 579; *Owen's Lake near Olancha*, Stejneger, 1893, p. 200, U.S.N.M.; *Panamint Valley at Hot Springs*, Cope, 1900, p. 579; *Panamint Mts. at Willow Creek*, Cope, 1900, p. 579; *rocks near crossing of Olancha Creek and Aqueduct at 3,800 feet*, M.V.Z.U.C.; *sand half a mile southwest of Olancha at 3,655 feet*, M.V.Z.U.C.; *Sarcobatus Flat*, Van Denburgh, 1922, p. 512, F.M.N.H.; *Searls*, Van Denburgh, 1922, p. 512; *Shepherd Canyon*, Van Denburgh, 1922, p. 512; *Shoshone, on sandy wash at 1,500 feet*, M.V.Z.U.C.; *White Mts. at 7,000 feet*, Van Denburgh, 1922, p. 512; *Wild Rose Canyon in the Panamint Mts. at 4,000 feet*, M.V.Z.U.C.; *Wild Rose Springs*, Van Denburgh, 1922, p. 512, F.M.N.H.). Kern County (*Bakersfield*, Van Denburgh, 1922, p. 579; *8 miles northeast of Bakersfield*, M.V.Z.U.C.; *20 miles south of Bakersfield*, Van Denburgh, 1922, p. 579; *20 miles south and 8 miles west of Bakersfield*, M.V.Z.U.C.; *Buena Vista Lake*, Van Denburgh, 1922, p. 579, C.A.S.; *Caliente Creek Wash at 600 feet*, M.V.Z.U.C.; *mouth of Caliente Creek*, M.V.Z.U.C.; *Cameron*, Van Denburgh, 1922, p. 512; *canebrake near Walker Pass*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Fay Creek at Weldon*, M.V.Z.U.C.; *Fay Creek, 6 miles north of Weldon*, M.V.Z.U.C; *Freeman Canyon on the east slope of Walker Pass at 4,900 feet* M.V.Z.U.C.; *Kelso Creek Canyon opposite Pinyon Creek Canyon, 8½ miles southeast of Weldon*, M.V.Z.U.C.; *Kelso Creek Valley, 6 miles southeast of Weldon at 3,100 feet*, M.V.Z.U.C.; *Kern River below Bodfish at 2,000 feet*, M.V.Z.U.C.; *Kern River near Bodfish*, Van Denburgh, 1922, p. 579, M.V.Z.U.C.; *Kern River at Isabella*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Kern River between Isabella and Kernville at 2,500 feet*, M.V.Z.U.C.; *Kern River, 4 miles above Kernville*, M.V.Z.U.C.; *Kernville*, Stejneger, 1893, p. 201, U.S.N.M.; *McKittrick*, Van Denburgh, 1922, p. 579, M.V.Z.U.C.; *Mohave*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Mount Breckenridge*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Onyx*, Van Denburgh, 1922, p. 579, M.V.Z.U.C.; *Mouth of San Emigdio Creek at 60 feet*, M.V.Z.U.C.; *San Emigdio Plain*, Camp, 1916*a*, p. 71, M.V.Z.U.C.; *Walker Basin*, Stejneger, 1893, p. 201, U.S.N.M., M.V.Z.U.C.; *Weldon*, M.V.Z.U.C.; *west slope of Walker Pass at 4,600 feet*, M.V.Z.U.C.; *Wheeler Ridge at 600 feet*, Van Denburgh, 1922, p. 579, M.V.Z.U.C.). Lake County (*Kelseyville*, Van Denburgh, 1922, p. 518, Stanford). Los Angeles County (*Antelope Valley*, Camp, 1916, p. 71, U.S.N.M., M.V.Z.U.C.; *Arroyo Seco near Pasadena*, Van Denburgh, 1922, p. 518; *Cajon Wash*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Claremont*, Van Denburgh, p. 518; *5 miles east of Claremont*, Mich.; *Elizabeth Lake*, U.S.N.M.; *Fairmont*, Grinnell and Grinnell, 1907, p. 57, C.A.S., U.S.N.M.; *Gorman*, Van Denburgh, 1922, p. 512; *Lankersheim*, Van Denburgh, 1922, 518; *Los Angeles*, Yarrow, 1882, p. 43, U.S.N.M.; *Pallett*, Van Denburgh, 1922, p. 512; *Pasadena*, M.V.Z.U.C., Taylor; *Placerita*, U.S.N.M.; *Placerita Canyon*, C.A.S.; *Pomona*, Mich.; *Rock Creek*, M.V.Z.U.C.; *San Gabriel Mts.*, U.S.N.M.; *San Gabriel Wash near Azusa*, U.S.N.M.; *Sierra Madre*, Van Denburgh, 1922, p. 518, M.V.Z.U.C., Mich., A.M.N.H., Baylor, C.A.S.; *Tujunga*

River, Van Denburgh, 1922, p. 518, C.A.S.). Madera County (*Coarsegold*, Van Denburgh, 1922, p. 518, U.S.N.M.; *Raymond at 940 feet*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.). Mariposa County (*Dudley*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *between Kinsley and McCauley's*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Pleasant Valley at 800 feet*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Smith Creek, 6 miles northeast of Coulterville*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.). Modoc County (*Warner Valley*, U.S.N.M.). Mono County (*Benton*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Mono Lake*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.). Monterey County (*Abbott's ranch, Arroyo Seco*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Big Creek*, Stanford; *between Bradley and King City*, Stanford; *Carmel Valley*, Van Denburgh, 1922, p. 518, C.A.S., F.M.N.H.; *Carmel Valley near dam*, Stanford; *Arroyo Seco in the vicinity of Chalk Peak*, Van Denburgh, 1922, p. 518; *on brushy hillside 1¼ miles south of Chalk Peak*, M.V.Z.U.C.; *Hames*, Van Denburgh, 1922, p. 518, C.A.S.; *King City*, Stanford; *below Monterey Bay in the Carmel River Valley*, Stanford; *Tassajara Creek*, Van Denburgh, 1922, p. 518, U.S.N.M.). Orange County (*Laguna Beach*, Van Denburgh, 1922, p. 522; *Santa Ana*, M.V.Z.U.C.). Placer County (*Lander*, C.A.S.; *Loomis*, Stanford). Riverside County (*Andreas Canyon near Palm Springs*, Van Denburgh, 1922, p. 522, M.V.Z.U.C.; *Abestos Springs*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *Banning*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *Blythe*, Cowles, 1920, p. 65, M.V.Z.U.C., C.A.S.; *Cabezon*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *Coachella*, Van Denburgh, 1922, p. 512, C.A.S.; *desert basins of the San Bernardino and San Jacinto Mts. near Coachella*, Van Denburgh, 1922, p. 512; *west of Coachella in the Jauchita Mts.*, C.A.S.; *Cottonwood Springs*, Van Denburgh, 1922, p. 512, C.A.S.; *Deep Canyon*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *6 miles east of Elsinore*, C.A.S.; *Gilman Hot Springs*, U.S.N.M.; *8 miles west of Hemet*, C.A.S.; *Hemet Lake*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *Hemet Valley*, Van Denburgh, 1922, p. 522, Stanford; *2 miles north of Kane Spring*, M.V.Z.U.C.; *Mecca*, M.V.Z.U.C., C.A.S., K.U.; *Murray Canyon*, Van Denburgh, 1922, p. 522; *Palm Springs*, Stone, 1911, p. 230, U.S.N.M., C.A.S., M.V.Z.U.C., San Diego Soc. Nat. Hist.; *Palm Canyon*, Cowles, 1920, p. 65, M.V.Z.U.C.; *Palm Springs at the mouth of Murray Canyon*, M.V.Z.U.C.; *1 mile southwest of Palm Springs*, M.V.Z.U.C.; *Perris Valley, near Riverside*, McLain, 1899*b*, p. 10; *Placerita Canyon*, U.S.N.M.; *Poppet Flat*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *Reche Canyon*, Van Denburgh, 1922, p. 522, M.V.Z.U.C.; *Riverside*, M.C.Z.; *Riverside Mts. along the Colorado River*, M.V.Z.U.C.; *San Gorgonio Pass*, Camp, 1916, p. 71; *San Jacinto*, Van Denburgh, 1922, p. 522; *north base of the San Jacinto Mts.*, Camp, 1916, p. 71, M.V.Z.U.C.; *San Jacinto Valley*, M.V.Z.U.C.;

Santa Ana Canyon, Grinnell, 1908, p. 163; *Santa Rosa Mts. near Carrizo Creek*, Van Denburgh, 1922, p. 522; *Snow Creek*, Van Denburgh, 1922, p. 522, M.V.Z.U.C.; *Tahquiz Canyon*, C.A.S.; *Temescal Mts.*, Van Denburgh, 1912, p. 151, Stanford; *Vallevista*, Atsatt, 1913, p. 39, M.V.Z.U.C.; *White Water*, M.V.Z.U.C.). San Benito County (*Bear Valley*, Van Denburgh, 1922, p. 518, U.S.N.M.). San Bernardino County (*Barstow*, Van Denburgh, 1922, p. 512, C.A.S.; *Blythe Junction*, Van Denburgh, 1922, p. 512, M.V.Z.U.C., C.A.S.; *Hesperia*, Van Denburgh, 1922, p. 512, C.A.S., K.U.; *Horn mine*, M.V.Z.U.C.; *5 miles south of Lavic*, M.V.Z.U.C.; *Leach Point Valley in the Mohave Desert region*, Stejneger, 1893, p. 200; *Lone Willow Springs*, Van Denburgh, 1922, p. 512, F.M.N.H.; *Ludlow*, Van Denburgh, 1922, p. 512, U.S.N.M., C.A.S.; *10 miles east of Ludlow*, Mich.; *14 miles west of Ludlow*, Mich.; *Lyons*, Stone, 1911, p. 230; *Lytle Creek*, Van Denburgh, 1922, p. 522; *Needles*, Cowles, 1920, p. 65, U.S.N.M., C.A.S., M.V.Z.U.C.; *Oro Grande*, U.S.N.M.; *Providence Mts. at 2,800 feet*, Cowles, 1920, p. 65; San Bernardino Mts., Van Denburgh, 1922, p. 522, C.A.S.; *north wall of Upper Santa Ana Canyon near Cedar Cabin Camp at 5,500 feet*, Grinnell, 1908, p. 163, M.V.Z.U.C.; *Turtle Mts.*, Camp, 1916, p. 530, C.A.S.; *Victorville*, Cowles, 1920, p. 65, M.V.Z.U.C., C.A.S.; *Warren's Wells*, Van Denburgh, 1922, p. 512). San Diego County (*Amago*, Klauber[22]; *6 miles east of Borega Springs*, San Diego Soc. Nat. Hist.; *Borega Valley*, Klauber; *3 miles south of Buckman's*, Klauber; *Campo*, Van Denburgh, 1922, p. 522, C.A.S., Mich.; *6½ miles east of Campo*, Klauber[22]; *Chihuahua Mts.*, Van Denburgh, 1912*b*, p. 151, Stanford; *Clogstons Valley, near San Diego*, Stanford; *Cuyamaca*, Van Denburgh, 1912*b*, p. 151; *Dehesa*, Klauber[22]; *Descanso*, F.M.N.H., Klauber; *6 miles east of Descanso*, Klauber[22]; *Dover Flat*, Klauber; *Dulzura*, Klauber; *Escondido*, Van Denburgh, 1922, p. 522, M.V.Z.U.C., Baylor; *Escondido Reservoir*, M.V.Z.U.C.; *Jacumba Hot Springs*, U.S.N.M.; *Japatul School*, C.A.S.; *Julian Mts.*, Stanford; *Laguna*, Klauber[22]; *4 miles west of La Posta*, Klauber[22]; *La Puerta*, Van Denburgh, 1922, p. 522, M.V.Z.U.C., San Diego Soc. Nat. Hist.; *Mountain Springs*, M.V.Z.U.C.; *4 miles southwest of Mountain Springs*, Klauber[22]; *Oak Grove*, McLain, 1899, p. 10, Klauber; *Palomar Mountain*, Taylor; *mouth of Peterson Canyon*, C.A.S.; *Pine Valley*, Klauber, San Diego Soc. Nat. Hist.; *Rainbow*, Klauber[22]; *Ramona*, San Diego Soc. Nat. Hist.; *Rincon*, Klauber; *San Anofre*, C.A.S.; *San Felipe Valley*, Klauber[22]; *Santa Ysabel*, Klauber[22]; *11 miles north of Seventeen Palms, northeast part of county*, Klauber[22]; *10 miles south of Seventeen Palms, eastern part of county*, Klauber[22]; *3 miles west of Wildwood*, Klauber[22]; *Vallecito*, Van Denburgh, 1922, p. 522, M.V.Z.U.C.; *Viejas*, Klauber[22]; *Warner Pass*, Van Denburgh, 1922, p. 522,

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[22] Personal reports from L. M. Klauber.

M.V.Z.U.C., Stanford; *Witch Creek*, Cope, 1900, p. 579, U.S.N.M., *8 miles east of Yaqui Well*, Klauber[22]; *4 miles southwest of Yaqui Well*, Klauber[22]). San Luis Obispo County (*San Juan ranch on the San Juan River*, Van Denburgh, 1922, p. 518, C.A.S.; *Santa Margarita at 996 feet*, Camp, 1916, p. 71, M.V.Z.U.C.). Santa Barbara County (*Montecito Peak*, Carnegie; *Sycamore Canyon*, Carnegie). Santa Clara County (Bell's Station, McLain, 1899, p. 10, M.V.Z.U.C.; *Los Gatos*, Van Denburgh, 1922. p. 518, C.A.S., Stanford; *Smith Creek*, Van Denburgh, 1922, p. 518). Shasta County (*General Report*, U.S.N.M.; *Baird*, Van Denburgh, 1922, p. 518; *McCloud River*, Van Denburgh, 1922, 518). Siskiyou County (*McCloud*, U.S.N.M.). Sonoma County (*Bodega*, U.S.N.M.). Sutter County (*Marysville Buttes*, Van Denburgh, 1922, p. 518, U.S.N.M.; *Pennington*, U.S.N.M.). Tehama County (*Mill Creek*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *Paine's Creek*, M.V.Z.U.C.). Tulare County (*Allee's ranch, south fork of the Kaweah*, U.S.N.M.; *Earlinart*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *East Fork of the Kaweah River*, Stejneger, 1893, p. 201, U.S.N.M., C.A.S.; *Three Rivers*, Stejneger, 1893, p. 201, U.S.N.M.; *Tipton*, Van Denburgh, 1922, p. 518, M.V.Z.U.C.; *White River*, Stanford). Ventura County (*Matilija*, Camp, 1916, p. 71, M.V.Z.U.C.). Yolo County (*Ramsey*, Van Denburgh. 1922, p. 518, M.V.Z.U.C.).

COLORADO.—Mesa County (*Dolores River Canyon as far down as the mouth of West Creek*, Cary, 1911, p. 26; *Grand Junction*, U.S.N.M., F.M.N.H., *Plateau Creek*, *5 miles east of tunnel*, Cary, 1911, p. 26, U.S.N.M.). Montezuma County (McElmo, U.S.N.M.). Montrose County (*Sinbad Valley*, Cary, 1911, p. 26; *West Paradox Valley*, Cary, 1911, p. 26).

IDAHO.—Ada County (*General Report, F.M.N.M.;* Boise, Van Denburgh, 1922, p. 512, C.A.S., Mich; *Snake River Canyon*, Carnegie; *Snake River Valley southeast of Melba*, F.M.N.H.; *Swan Falls on the Snake River*, M.V.Z.U.C., M.C.Z., Mich.). Canyon County (*Given's Hot Springs in the Snake River Valley*, M.V.Z. U.C.; *Payette*, Van Denburgh, 1922, p. 512, U.S.N.M.; *Snake River Valley across from Given's*, Klauber). Cassia County (*Conant*, Van Denburgh, 1922, p. 512). Elmore County, (*Glenn's Ferry*, Van Denburgh, 1912, p. 157, U.S.N.M.). Gooding County (*Bliss*, Van Denburgh, 1922, p. 512). Logan County (*Blue Lake*, Stanford; *Blue Lakes Canyon*, McLain, 1899, p. 9; *sage plain near Blue Lakes*, McLain, 1899. p. 9; *between Blue Lakes and Shoshone Falls*, Stanford). Owyhee County (*18 miles south of Brunneau*, M.C.Z.; *Brunneau River Canyon*, F.M.N.H.; south of Nampa, Carnegie; *south of Walter's Ferry*, Klauber). Twin Falls County (*Snake River plains near Upper Salmon Falls*, Van Denburgh, 1912, p. 157, Stanford; *valley of the Snake River between Shoshone Falls and Twin Falls*, Van Denburgh, 1912, p. 157, U.S.N.M.).

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[22] Personal reports from L. M. Klauber.

NEVADA.—Churchill County (*Hazen*, Burt, Mich.). Clark County (*bend of the Colorado*, Van Denburgh, 1922, p. 512; *Callville*, Stejneger, 1893, p. 208, U.S.N.M.; *Las Vegas*, Stone, 1911, p. 230, C.A.S.; *St. Thomas*, Cope, 1900, p. 579, U.S.N.M., A.N.S.P.; *valley of the Muddy River*, Van Denburgh, 1922, p. 512; *valley of the Virgin River*, Van Denburgh, 1922, p. 512; *Vegas Valley*, Van Denburgh, 1922, p. 512). Elko County (*Carlin*, Cope, 1900, p. 579, U.S.N.M., Mich., C.A.S.; *Elko*, U.S.N.M.; *Lower Annie Creek in the Humboldt River Valley near Carlin*, Mich.; *Maggie Basin*, Ruthven, 1915*b*, p. 950, Mich.) Esmeralda County (*7 miles north of Arlemont*, M.V.Z.U.C.; *Arlemont*, M.V.Z.U.C.; *Dyer*, M.V.Z.U.C..; *Fish Lake*, M.V.Z.U.C.; *Cave Spring at 6,200 feet*, M.V.Z.U.C.; *Goldfield*, Van Denburgh, 1922 p. 512, C.A.S.). Eureka County (*Palisade*, Van Denburgh, 1922, p. 512). Humboldt County (*Big Creek Ranch at the base of the Pine Forest Mts.*, M.V.Z.U.C.; *Golconda*, Van Denburgh, 1922, p. 512, U.S.N.M.; *Pine Forest Mts.*, Van Denburgh, 1922, p. 512, M.V.Z.U.C.; *Thousand Creek*, Van Denburgh, 1922 p. 512; *Winnemucca*, Van Denburgh, 1922, p. 512). Lincoln County (*Caliente*, Van Denburgh, 1922, p. 512, C.A.S., Stanford; *Desert Valley*, Van Denburgh, 1922, p. 512; *Meadow Creek Valley*, Van Denburgh, 1922, p. 512; *Pharanagat Valley*, Stejneger, 1893, p. 200, U.S.N.M.). Mineral County (*Endowment Mine in the Excelsior Mts. at 6,500 feet*, M.V.Z.U.C.; *Marietta at 4,900 feet*, M.V.Z.U.C.). Nye County (*Amargosa Valley*, Van Denburgh, 1922, p. 512; *Oasis Valley*, Stejneger, 1893, p. 200, U.S.N.M.; *Rhyolite*, Van Denburgh, 1922, p. 512, C.A.S.; *Shoshone Point*, U.S.N.M.; *Tonopah*, Van Denburgh, 1922, p. 512, C.A.S.). Ormsby County (*Carson City*, Van Denburgh, 1922,p. 512, U.S.N.M., Stanford). Washoe County (*Anaho Island in Pyramid Lake*, C.A.S.; *Derby*, Stanford; *Nixon*, C.A.S.; *Pyramid Lake*, Van Denburgh, 1922, p. 512, U.S.N.M., C.A.S., Stanford; *near head of Pyramid Lake*, U.S.N.M., Stanford; *Pyramid Lake Indian Agency*. C.A.S.; *between Reno and Pyramid Lake*, Cope, 1900, p. 587. A.N.S.P.; *Smoke Creek Desert*, U.S.N.M.; *Sutcliffe*, Taylor; *Wadsworth*, Van Denburgh, 1922, p. 512, U.S.N.M.; *Willows, Pyramid Lake*, Stanford).

NEW MEXICO.—Bernalillo County (*Albuquerque*, Van Denburgh, 1924, p. 213, U.S.N.M.). Dona Ana County (*Aden*, Bradley, 1919, p. 414; *3 miles west of Cambray*, Burt, Mich.; *Las Cruces*, Cope, 1900, p. 579, U.S.N.M., M.C.Z.; *15 miles north of Las Cruces*, Van Denburgh, 1924, p. 213; *15 miles west of Las Cruces*, Burt, Mich.; *16 miles west of Las Cruces*, Burt, Mich.). Grant County (*Hachet Ranch*, U.S.N.M.; *12 miles north of Rodeo*, Burt, Mich.;

10 miles south of Steins, Burt, Mich.). Guadalupe County (*Santa Rosa*, U.S.N.M., Carnegie). Luna County (*Cambray*, Burt, Mich.; *Deming*, *Stone*, 1911, p. 230; *10 miles east of Deming*, Burt, Mich.). Otero County (*5 miles south of Alamogordo*, Mich.; *alluvial slope east of Alamogordo*, Ruthven, 1907, p. 563, A.M.N.H.; *lower margin of alluvial slope east of Alamogordo*, Ruthven, 1907,, p. 563, A.M.N.H.; *upper part of alluvial slope east of Alamogordo*, Ruthven, 1907, p. 563, A.M.N.H.; *between Alamogordo and Dry Canyon*, A.M.N.H., A.N.S.P.; *Dry Canyon in the Sacramento Mts.*, A.M.N.H., A.N.S.P.). Rio Arriba County (*Espanola at 5,000 feet*, Van Denburgh, 1924, p. 213, U.S.N.M.). Sierra County (*Elephant Butte Dam*, Mich.; *near north end of Elephant Butte Dam*, Taylor; *25 miles northwest of Elephant Butte Dam*, Taylor). Socorro County (*Socorro*, U.S.N.M.).

OREGON.—Baker County (*3 miles northeast of Huntington*, Van Denburgh, 1922, p. 512, U.S.N.M.).

TEXAS.—The desert whiptail is confined to the western part of the State. Armstrong County (*General Report*, U.S.N.M., M.C.Z.; *Dripping Springs Draw, 15 miles southwest of Goodnight*, Strecker, 1910, p. 8; *near head of Rush Creek*, Strecker, 1910, p. 8, Baylor, Mich., C.A.S.). Brewster County (*Hills at Boquillas*, Bailey, 1905, p. 44; Mich; *Chitocotal*, Mich.; *Glenn Springs*, Mich.; *2 miles north of Glenn Springs*, Mich.; *3 miles north of Glenn Springs*, Mich.; *flats 9 miles south of Glenn Springs*, Mich.; *Hot Springs*, Mich.; *Lower Juniper Canyon*, Mich.; *Lindsey mine*, Mich.; *Rice Draw*, Mich.; *Rice ranch*, Mich.; *flats about the Rio Grande*, Mich.; *Terlingua*, Strecker, 1909, p. 14, Baylor; *Windmill Flat*, Mich.). Culberson County (*Van Horn*, Bailey, 1905, p. 44, U.S.N.M.). El Paso County (*El Paso*, Gadow, 1906, p. 370, A.M.N.H., M.C.Z., Baylor, F.M.N.H., C.A.S., K.U.; *Fort Hancock*, U.S.N.M.; *foot of Franklin Mts.*, A.M.N.H.; *mesa east of Franklin Mts.*, Stone, 1911, p. 230, A.N.S.P.; *Plateau*, Burt, Mich.; *2 miles east of Tornillo*, Burt, Mich.). Jeff Davis County (*Cherry Valley*, Mich., M.C.Z.; *Davis Mts.*, Ruthven, 1920, p. 243, Mich.; *Phantom Lake*, Mich.). Pecos County (*Fort Stockton*, Bailey, 1905, p. 44, U.S.N.M.). Reeves County (*Barillo Camp*, Burt, Mich.; *Pecos*, Brown, 1903, p. 548, A.N.S.P.; *Pecos Valley*, Mich.; *Weinacht's Draw*, Mich.). Val Verde County (*Langtry*, Bailey, 1905, p. 44, U.S.N.M.). Ward County (*Monahans*, Bailey, 1905, p. 44, U. S. N. M.). Webb County (*Laredo*, Yarrow, 1882, p. 45, U.S.N.M.).

UTAH.—Beaver County (*Beaver Creek at 6,000 feet*, Van Denburgh, 1922, p. 513, U.S.N.M., A.M.N.H.; *Newhouse*, Van Denburgh and Slevin, 1915, p. 105, C.A.S.; *San Francisco Mts.*, Cope, 1883, p. 14). Boxelder County (*Brigham*, B.Y.U.). Davis County

(*Clearfield*, Van Denburgh, 1922, p. 513, A.M.N.H.: *Farmington*, Mich.). Emery County (*Greenriver*, Van Denburgh and Slevin, 1915, p. 105, B.Y.U., C.A.S.; *north of Greenriver*, Mich.; *northwest of Greenriver*, Mich.; *southwest of Greenriver*, Mich.) Grand County (*north of Elgin*, Mich.; *south of Elgin*, Mich.; *southeast of Elgin*, Mich.; *Moab*, B.Y.U.; *Thompson*, Van Denburgh and Slevin, 1915, p. 105, C.A.S.; *Thompson's Spring*, Baylor). Iron County (*Cedar City*, Mich.; *Rush Lake*, Van Denburgh, 1922, p. 513, C.A.S.). Jaub County (*Fish Springs*, Mich.). Kane County (*Kanab*, B.Y.U.). Millard County (*7 miles south of Kanosh*, Van Denburgh, 1922, p. 513, C.A.S.). Piute County (*below Big Cottonwood and Little Cottonwood Rivers at 4,500 feet*, Mich.). Salt Lake County (*Dry Canyon north of Salt Lake City*, Mich.; *Fort Douglas*, Van Denburgh and Slevin, 1915, p. 105, C.A.S.: *east of Sandy at 5,000 feet*. Mich.; *first branch east of Sandy*, Mich.; *branch west of Sandy*, Mich). San Juan County (*Bluff*, B.Y.U.). Tooele County (*Cedar Mts.*, M.C.Z., Mich.; *desert, 15 miles north of Ibapah*, B.Y.U.). Uinta County (*Dinosaur Quarry near Jensen*, Tanner, 1927, p. 56, B.Y.U.; *25 miles west of Dragon*, F.M.N.H.; *Jensen*, U.S.N.M.: *White River*, Carnegie). Utah County, (*Lehi*, M.C.Z.). Wasatch County (*Little Willow Canyon at 5,250 feet*, Mich.: *Trout Creek*, Mich.). Washington County (*General Report*, M.C.Z.: *Leeds*, Van Denburgh, 1922, p. 512, U.S.N.M., C.A.S.; *Lower Santa Clara Valley*, Van Denburgh, 1922, p. 512; *Rockville*, Van Denburgh, 1922, p. 512, C.A.S.; *between Rockville and Springdale*, Van Denburgh, 1922, p. 512, C.A.S.; *Santa Clara*, U.S.N.M.; *Upper Santa Clara Crossing*, Van Denburgh, 1922, p. 512; *St. George*, Tanner, 1927, p. 56, B.Y.U., M.V.Z.U.C., C.A.S., Mich.; *Virgin City*, Van Denburgh, 1922, p. 512, A.M.N.H.; *6 miles north of Washington*, Van Denburgh, 1922, p. 512, C.A.S.; *Zion National Park*, Tanner, 1927, p. 56). Weber County (*Fremont Island in the Great Sale Lake*, M.C.Z.).

In Mexico, *C. tessellatus tessellatus* has been taken much less often than in the United States. Reports are available for the following states.

CHIHUAHUA.—(*Cerro Chilicote*, U.S.N.M., M.C.Z.; *Chihuahua*, Cope, 1887, p. 44, Stanford; *Guzman*, F.M.N.H.; *Santa Rosalia*, U.S.N.M.).

COAHUILA.—(*Castanuelas*, Cope, 1887, p. 45; *Monclova*, U.S.N.M.; *Parras*, Cope, 1900, p. 589, U.S.N.M.).

DURANGO.—(*Lerdo*, Gadow, 1906, p. 372, F.M.N.H.).

LOWER CALIFORNIA.—Northern district (*Agua Escondido*, Meek, 1905, p. 14; *Canyon Esperanza*, Meek, 1905, p. 14, F.M.N.H.; *Cerro Priete, delta region of the Colorado River*, M.V.Z.U.C.; 7

miles east of Cerro Priete, M.V.Z.U.C.; *El Cajon Canyon, east base of the San Pedro Martir Mts.*, M.V.Z.U.C.; *El Mayor*, M.V.Z.U.C.; *Ensenada*, Van Denburgh, 1922, p. 522, C.A.S.; *Las Cabras*, C.A.S.; *between Lareta and Comondu*, U.S.N.M.; *Matomi*, Meek, 1905, p. 14, F.M.N.H.; *Parral*, Meek, 1905, p. 14, F.M.N.H.; *20 miles south of Pilot Knob, Colorado River*, M.V.Z.U.C.; *Rosario Divide*, Meek, 1905, p. 14, F.M.N.H.; *San Antonio*, Meek, 1905, p. 14, F.M.N.H.; *San Domingo*, C.A.S.; *San Felipe*, Van Denburgh, 1922, p. 522, U.S.N.M., San Diego Soc. Nat. Hist., F.M.N.H.; *San Felipe Bay*, Schmidt, 1922, p. 673, U.S.N.M., F.M.N.H.; *San Jose, San Pedro Martir Mts.*, M.V.Z.U.C., C.A.S.; *4 miles west of San Jose*, C.A.S.; *San Matias*, Van Denburgh, 1922, p. 522; *East Base of the San Pedro Mts.*, M.V.Z.U.C.; *foothills of the San Pedro Martir Mts.*, Van Denburgh, 1895, p. 126, U.S.N.M.; Stanford; *San Quintin*, F.M.N.H.; *San Rafael*, Stanford; *between San Rafael and Ensenada*, Van Denburgh, 1895, p. 126, Stanford; *Santa Cruz Canyon*, C.A.S.; *San Telmo*, Van Denburgh, 1895, p. 126, Stanford; *Trinidad*, Meek, 1905, p. 14, F.M.N.H.; *Valladares, San Pedro Martir Mts.*, M.V.Z.U.C.). Central district (*Abrejos Point, Ballenas Bay*, Dickerson, 1919, p. 476; *Angeles Bay*, Van Denburgh, 1922, p. 513, C.A.S.; *Comondu to San Quintin*, Van Denburgh, 1895, p. 126, Stanford; *Las Animas Bay*, Van Denburgh, 1922, p. 513, C.A.S.; *San Bartolome Bay*, Dickerson, 1919, p. 476, U.S.N.M., C.A.S., A.M.N.H.; *San Fernando*, Cope, 1900, p. 600, U.S.N.M.; *San Francisquito Bay*, Van Denburgh, 1922, p. 522, C.A.S.; *Santa Rosalia*, Mocquard, 1899, p. 673; *Turtle Bay*, *U.S.N.M.*). Coastal islands (east) in the Gulf of California (*Angel de la Guardia*, Van Denburgh, 1922, p. 535, C.A.S.; *Isla Partida near Angel de la Guardia*, Van Denburgh and Slevin, 1921, p. 98, C.A.S., A.M.N.H., M.C.Z.; *Pond Island near Angel de la Guardia*, *C.A.S.*; *San Esteban Island*, Van Denburgh, 1922, p. 536, C.A.S.,A.M.N.H.; *Smith Island*, Van Denburgh, 1922, p. 513, C.A.S.). Coastal Islands (west) in the Pacific Ocean (*Cerros*, Cope, 1892, p. 38, U.S.N.M., C.A.S., M.C.Z.; *north end of Cerros*, M.V.Z.U.C.; *Coronodo Island*, U.S.N.M.; *South Coronodo Island*, Van Denburgh, 1922, p. 522, M.V.Z.U.C., San Diego Soc. Nat. Hist.; *Natividad Island*, Van Denburgh and Slevin, 1914, p. 145, C.A.S., M.C.Z.; *San Benito Islands, west of Cerros*, U.S.N.M.).

SONORA.—(*Guaymas*, Van Denburgh, 1922, p. 532, U.S.N.M., M.C.Z.; *Hermosillo*, Cope, 1900, p. 538, U.S.N.M.; *San Pedro Bay, west coast north of Guayamas*, Van Denburgh, 1922, p. 532; *Tepoca Bay, west coast*, Cope, 1900, p. 532; *Tiburon Island*, Dickerson, 1919, p. 473, U.S.N.M., A.M.N.H., C.A.S.).

Habitat.—The tessellated lizard occurs over an unusually large area, and furthermore over one of great environmental diversity.

The species seems partial to sandy areas, but shows the ability to become adapted to a habitat of rocks or brush. By successfully meeting these conditions, *tessellatus* has shown itself to be one of the most plastic of American lizards.

In California (Stejneger, 1893, p. 199) the tessellated lizard has been found to inhabit the open desert of Death Valley, and it has been reported from the Salton Sink at 265 feet below sea level (Cowles, 1920, p. 65).

On the gravelly washes along the bases of the mountains the whiptail is frequently seen during the months of June, July, and August. It is fairly numerous in the Arroyo Seco, Tujunga and San Gabriel Washes, and occurs also in favorable places on the hot slopes well up into the mountain ranges (Los Angeles County). Close around Pasadena, the whiptail lizard is now much less abundant than formerly. It used to occur about Devil's Gate in the same sort of region that the road-runner and the cactus wren like. All of these native inhabitants are becoming scarce as the region is settled and hunters persecute its wild life more persistently. (Grinnell and Grinnell, 1907, p. 35.)

On the mesa among the cactus plants at Cabezon, Calif. (Atsatt, 1913, p. 40), and at Snow Creek amid the leaves under the cottonwoods or among the rocks, this species has been frequently seen. In the vicinity of the Turtle Mountains of southeastern California the whiptail lizard seems to occur abundantly in every phase of the environment, except the rocky mesa, from hillside to sand dune. (Camp, 1916, p. 530.) It was especially well represented on the rocky hillsides where individuals ceaselessly forage.

In the Yosemite region the swiftest of all lizards is the California whiptail, which occurs at certain locations in the western part of the section. This reptile is ordinarily considered as an inhabitant of the desert regions, and in truth it is. But it also occurs, or did formerly, on much of the floor of the San Joaquin Valley, and it penetrates into the foothills wherever there are conditions suitable for its existence. (Grinnell and Storer, 1924, p. 632.) Its distribution in this region is not continuous, however.

From the ocean to the desert in the brushy areas of San Diego County, Klauber (1928, p. 4) found the darker phase of this lizard to be common. On the desert in "sandy, rockstrewn areas" the lighter or brownish phase was found to appear, however.

In the Great Basin of the United States—that is, in the country between the Sierra Nevada and the Rockies—the dorsal coloration of *tessellatus* is predominantly brown and the ventral coloration often deep black or slaty. Here this subspecies occurs chiefly in the sandy habitat.

In western Colorado Cary (1911, p. 26) considered the arid "Lower Sonoran Zone" as its center of abundance, for here he found it only in the hottest and lowest desert valleys.

In referring to this subspecies in Nevada, Taylor (1912, p. 334) cites it as breeding in the "Lower Sonoran" elsewhere (referring to Cary, 1911) and as "probably breeding in the Upper Sonoran" of Nevada (Grinnell and Storer, 1924. p. 632, definitely assigned it to the Upper Sonoran of the Yosemite region of California). Perhaps it is simply restricted to the lower levels of the mountains. On the sides of the dry washes and on the open, flat deserts in the vicinity of the foothills, Taylor found the tessellated lizard in small numbers up to an altitude of 5,000 feet on the low ridges (Humboldt County). Ruthven (1915*b*, p. 950), also working in Nevada, found it only on the floor of Maggie Basin. He therefore considered it a ground form confined to areas of fine soil.

According to Ruthven (1907, p. 563) the habitat of this lizard at Alamogordo, New Mex., is very well defined. Examples were rather definitely restricted to the "Creosote bush association" on the alluvial slopes, where they were almost as characteristic of the area as the creosote bush itself. On the greasewood plains at Tucson, Ariz., he found the desert whiptail to be common and generally distributed. It was also seen on the mesas, but more often in the "creosote bush association" in the arroyos, and much less commonly in the "Suaharo-Ocotillo association" of the hills. Working in the same general region, Ortenburger and Ortenburger (1926, p. 111) collected a large number of these creatures and reported on the most of them as "*melanostethus*" and on only a few of them as *tessellatus*. In regard to the latter, they stated that this was the least common form of *Cnemidophorous* that they found. They took only three specimens and "all of these were collected some distance up the canyons in the foothills of the Santa Catalinas; that is, from 2 to 3 miles from the desert floor." This seems to indicate (as elaborated above, p. 174) that the presence or absence of a ventral suffusion of black is correlated with the type of environment, the lighter form inhabiting the more mountainous and less sandy districts, and the darker form (often called "*melanostethus*") the more sandy and less mountainous parts.

A remarkable uniformity in the type of habitat selected by these lizards was observed by the writer in the summer of 1928 from Western Texas to Eastern California. In general the areas with the loosest soil supported the greatest numbers of individuals, and those regions in which the soil was hard or packed relatively few of them. Specimens taken in Reeves and El Paso counties, Texas, were all found in somewhat sandy areas where they were afforded protection by the low-lying shrubs of this semiarid habitat, as well as by the numerous rocks and boulders.

A habitat of finer sand was found as New Mexico was entered from El Paso. In Dona Ana County this sand was light brown in color and mesquite bushes were very common and often low and wide spreading. In Luna County the soil was more loamy and the mesquite had largely disappeared (vicinity of Cambray), although yucca and burning bush were present. Some grass could be found in the interspaces between the shrubs. Only two specimens were secured in this environment, while several dozen were taken within a few hours in the sandy "mesquite association" in Dona Ana County. In Grant County, 10 miles south of Steins, the mesquite was more abundant but was accompanied by a mixture of desert shrubbery, such as greasewood, broomwood, and soapweed. The sand was coarse and there were many large rocks. After a careful search only one specimen was taken, but later at another place (12 miles north of Rodeo), where the sand was finer again, reddish, and more abundant, 24 examples were collected within an hour.

In Arizona the situation was much the same as in New Mexico. In Pinal County whiptails were secured in large numbers in various sandy areas where mesquite was the dominant vegetation and in smaller numbers where there was less sand and more kinds of shrubbery. In Yuma County gradual transition was noted from a "mesquite association" to one in which bunch grass was the most conspicuous kind of plant. Here, fine sand was the prevailing type of soil and no great difference in the abundance of whiptails in each of the two habitats could be detected by casual observation. Thus, at this point, the character of the soil, rather than the type of plant life, seems to be the important factor in influencing the distribution of the tessellated lizard.

Apparently nothing is known about the Mexican or Lower Californian habitat of *tessellatus* and only two short notes have been published concerning the environment in which the various island populations are found.

Many have been seen "about the deserted nesting burrows of sea birds on Natividad Island" (Van Denburgh and Slevin, 1914, p. 145) and numerous other individuals were found "in the small brushy canyons and among fallen cacti" on Isla Partida (Van Denburgh, 1922, p. 535).

General behavior.—These lizards are diurnal in their habits and spend the night in an inactive state. During the day, according to Camp (1916, p. 530), *tessellatus* "slinks about hesitatingly on the sand, dragging its tail and leaving a characteristic track." These tracks may be seen wherever the sand is loose and the lizards are abundant.

From observations in the Texas panhandle Strecker (1910, p. 9) relates that "they were most active early in the morning, when they were out feeding along the edges of cow paths and around the bases of cedars growing along the canyon side. Several adults observed late in the evening were lying along the beveled edges of large masses of stone with their heads extending above the rim in order to get the full benefit of the declining rays of the sun."

In Texas, New Mexico, and Arizona the writer has found that these lizards ordinarily became active soon after sunrise and continue their activity well into the morning (July). Thus, a young desert whiptail observed at Hazen, Churchill County, Nev., at 7.30 a. m. on August 25, 1928, had taken a position on the eastern side of a desert bush, its head directed toward the morning sun. Here it remained perfectly still, apparently enjoying the warm rays. In the afternoon fewer specimens seem to be about and it is probable that after satisfying their hunger individuals retreat to some underground shelter for rest and digestion, coming out again only when disturbed or hungry.

Many remarks have appeared concerning the speed, flight, and concealment of the race runners and whiptails. In regard to *tessellatus*, Stejneger (1893, p. 199) seems to have been the first to state that "It runs with great rapidity when alarmed." Ruthven (1907, p. 563), working in the vicinity of Alamogordo, New Mex., noted that "When frightened, specimens did not seek concealment in the nearest bush, but dashed away swiftly for several rods before stopping. They generally stopped near a bush and after looking about for a moment slipped quietly into it, frequently leaving it directly again on the other side for a neighboring one. The tendency to repeat this process makes these lizards very difficult to capture." It was found by the present writer that when two collectors are working together they may turn the tendency of *tessellatus* to slip directly through a bush to advantage. When a lizard is seen or heard in a bush it may be "scared" to almost any side of the area by the approach of a person from the opposite quarter. If the second collector remains motionless on the side of the bush at which the whiptail is expected to appear, the animal, apparently unaware of the presence of danger, will usually come into full view.

A somewhat different behavior was reported at Cabezon, Calif., by Atsatt (1913, p. 40), who noted that they "ran along the ground and burrowed in the soft sand or crawled under cactus. At Snow Creek they took refuge between or under rocks without running along the ground for a great distance." A case similar to the latter was observed by the writer in Reeves County, Tex., where a specimen was seen taking shelter under a flat stone about a foot in diameter. According to Camp (1916, p. 530) "The tessellated lizard, when running swiftly, elevates its tail so that the ground is just cleared, and the tip lashes about as the lizard runs. Grinnell and Storer (1924, p. 632) have pointed out that this lizard is "specialized in somewhat the same manner as the kangaroo rat, and to achieve the same result. Its whole organization is modified for the attainment of speed in running on the surface of the ground. * * * The legs are stout, especially the hind pair, and the toes are long, particularly those of the hind feet. When frightened one of these animals appears to get over the ground, for a short distance at least, faster than a man can run. Its usual procedure is to start up suddenly, make a rapid dash of about 50 to 100 feet, then stop abruptly, often dodging around behind a bush at the instant of stopping. The long tail serves as a counterpoise and perhaps also as a rudder, in movement. The sudden start, extremely swift run, and quick stop are, to the human eye, confusing, and may have the same effect on any animal, such as the road-runner, which might attempt to prey on the lizards. When undisturbed the whiptail forages about with jerky movements of the body. The tail is then usually dragged on the ground and leaves a characteristic trail between the marks of the feet. When pursued one of these lizards will often take shelter in some hole in the ground, usually at the base of a bush. One was seen to enter a ground squirrel burrow."

The burrowing habits of *tessellatus* are interesting and have been rather fully recorded. The most complete account has been given by Pack (1918, pp. 51–52), who described the process of burrowing as follows: "The lizard began by scooping aside the sand with its front feet. It used these feet alternatingly, one stroke only being made by each foot at a time. Then, discontinuing the alternate strokes, it would rest one foot while making a number of backward strokes with the other. Soon it rested the employed foot and used the other. After a short time it reverted to the way of digging first described * * * When the burrow was well under way and the excavated sand began piling up, the lizard turned around in the depression, began slowly crawling outward, and instead of scooping aside the sand, pushed it back with the face of the hands. Then reentering the burrow, it resumed its digging, using the method already described * * * It continued burrowing until its movements were again interfered with by the accumulating sand, which it would once more push out. This process of digging was continued until the burrow was finished. The lizard then, with its head facing outward, assumed a resting position at the end of the excavation." Van Denburgh (1922, p. 519) wrote that when hard pressed "It often tries to elude pursuit by burrowing, although it can run very swiftly," and Grinnell and Storer (1924, p. 632) have written that "In places where there are no open rodent burrows, and where the soil is sufficiently loose, whiptails dig their own burrows."

The question of whether *tessellatus* ever shows climbing ability is apparently debatable, since there is both positive and negative evidence on this subject. Strecker (1910, p. 9) found that "This species is an active climber and unlike *gularis* never attempts to escape by entering burrows." In fact the only ones that he succeeded in driving to cover were "coiled up under rocks, much after the manner of *Crotaphytus collaris*" (Texas). Further positive support of the climbing habit was given by Richardson (1915, p. 425) who said that "It was occasionally observed to climb into bushes" (Nevada). Grinnell and Grinnell (1907, p. 35), on the other hand, wrote that they had never known the whiptail to climb trees or bushes or even rocks (California). Very recently, Woodbury (1928, p. 18) has found that the desert whiptail appears to be unable to climb well. "One cornered against the side of a frame cabin, in attempting to escape by climbing, fell off and made no further attempt to escape by that method." The writer's field observations in the Great Basin tend to support the negative side of the question, but it is nevertheless possible that certain individuals may acquire the climbing habit.

The behavior of this species in water has been recorded by Grinnell and Storer (1924, p. 632) as follows: "At Smith Creek a small specimen was seen in a pool of water, where it had evidently jumped when frightened by the approach of the observer. The animal was obviously unadapted to this element, for after a few strokes it sank to the bottom and was drowned." This seems to have a negative bearing on the question of whether such specialized terrestrial forms as these lizards may be conveyed from one land mass to another by flotation.

Food and feeding habits.—These whiptails are predaceous and chiefly insectivorous. Feeding activity was observed by Ruthven (1907, p. 563), who wrote that this species "was most frequently seen running about among the bushes picking up grasshoppers, beetles, locusts and ants, which constitute the bulk of its food." According to Camp (1916, p. 530), over the rocky hillsides of southern California, "individuals ceaselessly forage, sticking their sharp noses into little piles of leaves and débris or picking up small bits of food with their active tongues." Van Denburgh (1922, p. 535) noted on Isla Partida 12 individuals that were "picking up beetles and other insects which had been uncovered by the removal of stones in a small cleared space about 6 feet square" in a rock slide. Grinnell and Storer (1924, p. 632) found that "The whiptail subsists on insects. Some of these, such as grasshoppers, are obtained by stalking, just as a carnivorous mammal, such as the coyote stalks a ground squirrel. Other prey, such as cutworms and beetle larvae, are picked up from the surface of the ground about the bases of plants." Woodbury (1928, p. 18) watched an individual "feeding where insects had dropped on the ground at a light the night before. It picked up numerous ants and termites and it even took one of the termites from a large red ant but made no attempt to eat the latter. It also picked up moths, bugs, and other types of insects that were lying there dead or alive." If it were certain that some of the insects selected were *actually* dead and showed no signs of movement, due to wind or otherwise, when the lizard approached, the above would be an especially interesting observation. Both live and dead insects might have been on the ground, but the lizard may have eaten only live ones. It has been the writer's general impression that these lizards depend upon the movement of their prey for its detection. (Burt, 1928, p. 64.)

Apparently the first report of the analysis of the stomach contents of *tessellatus* was given by Stejneger (1893, p. 199), who wrote that the food consists of "grasshoppers and other insects—no leaves or flowers being found in the numerous stomachs examined." Ruthven (1907, p. 563) examined the stomach contents of specimens from Tucson, Ariz., and found the food to consist exclusively of spiders, ants, beetles, grasshoppers, and other insects. The same conclusion was reached by Ruthven and Gaige (1915, p. 26) from a study of Nevada specimens. Six Nevada specimens were taken on May 31 by Richardson (1915, p. 425) and he found that they had their stomachs filled with "white larvae and pieces of gravel." Camp (1916, p. 530) found a large grasshopper in the stomach of a Californian specimen and in another a small beetle, a spider, and a quantity of tiny yellow ants.

A rather extensive account of the food of *tessellatus* was presented by Pack (1923, pp. 85–90), who studied specimens in western Utah. A total of 63 stomachs were examined and the results were presented in tabular form. It was found that Lepidoptera, largely caterpillars, form 37.7 per cent of the food; grasshoppers, 14.4 per cent; beetles, 14.2 per cent, of which one-sixth are wire-worms; miscellaneous insects, 14.27 per cent; arachnids, 8.2 per cent; and sand and bits of wood, 2.23 per cent. "Hymenoptera, usually considered as one of the most beneficial orders of insects, represents less than 1 per cent of the total food. Without entering into a discussion of the economic status of the various items of food, it is evident that a high percentage of the total food consists of noxious insects. * * * It is physically possible for this lizard to consume large quantities of food." They are particularly useful because they often enter alfalfa fields, orchards and other cultivated areas. "The number of racerunners in agricultural sections is now much fewer than formerly. Great numbers have disappeared with reclamation of land, and unfortunately there has been an accompanying wanton destruction by firearms. Where the race runner comes into contact with cultivated lands it renders a service to agriculture" next to that of our most useful insectivorous birds. "Thus, it becomes evident that this lizard, in common possibly with the widespread eastern species (*sexlineatus*), is the most beneficial lizard in North America."

An instance of true cannibalism was reported by Ruthven and Gaige (1915, p. 26), who found that the stomach of a Nevada example contained "a young, recently hatched, specimen of *Cnemidophorus*." This young individual is considered to be *tessellatus* because other *Cnemidophori* are unknown from Nevada.

Life history.—The life history of the tessellated lizard is very imperfectly known, but the available data are sufficient to serve as a substantial basis for further studies.

There are apparently only two references to mating activity in the literature. Taylor (1912, p. 334), working in Nevada, stated that "Specimens were seen in copulation on June 10, and pairs were commonly seen after this date. On June 21, one was found pursuing another, but whether for purposes of play or by sexual instinct is not known. Van Denburgh (1922, p. 519) merely said that "It mates near Los Gatos (California) early in June."

The eggs also have been but rarely studied. An account given by McLain (1899*b*, p. 10) reads as follows: "Mr. Coolidge, while in the Chihuahua Mountains, San Diego County, Calif., during the summer of 1897, found four eggs of this form lying on top of the small pile of earth which he says is always found at the entrance to the burrows of these reptiles. They were lying in the open air exposed to the full glare of the sun, where they had evidently been left to incubate. The embryos were nearing the point of hatching, as all external characters (excepting coloration) were fully developed and the yolk sac was pretty well absorbed. The shell enveloping the young is a tough membranous structure, oval in shape and less than an inch in length." While collecting in the panhandle of Texas, Strecker (1910, p. 9) found two females with eggs, the number in each case being eight. He stated that these eggs resembled those of *gularis*, but were a little larger.

It is not definitely known when the eggs are deposited. However, Ruthven and Gaige (1915, p. 26) wrote that "Females collected as late as July 13 still carried their eggs, but those taken on August 8 had laid them. After a field expedition to northwestern Texas, Strecker (1910, p. 9) placed the following observations on record: "One morning near the water hole above camp I had the good fortune to surprise a female in the act of depositing her eggs. She was digging a hole in the loose sand, near the base of a shelving bank, using her forefeet, the long toes of the hind feet assisting in the operation by pushing the loose sand out of the excavation. After going to a depth of nearly 6 inches she turned around and began to deposit the eggs. At this period she became frightened * * * and scurried out of the hole * * *. I found the eggs covered with a thin layer of sand. This may have been her full complement, for she was not more than two-thirds grown. The hour was 7.30 a. m."

The incubation period under normal, or even abnormal, conditions has evidently not been determined, and the date that the young come from the egg is also unknown. The writer's field observations tend to indicate that the young are not hatched before the latter part of July (Texas, New Mexico, and Arizona). Ruthven and Gaige (1915, p. 26) found a young specimen in the stomach of an adult on August 14 (Nevada). An individual observed by the writer at Hazen, Churchill County, Nev., on August 25, 1928, was very young and may have been hatched only a short time.

Enemies.—Specimens of *tessellatus* no doubt form an item in the natural menu of certain of the carnivorous desert mammals. Probably the house cat is a formidable enemy in the more settled regions. Among birds, Grinnell and Grinnell (1907, p. 35) have reported the collection of a road runner whose stomach contained four full-sized whiptail lizards!

Ruthven (1907, p. 563) observed the tessellated lizard being preyed upon by the leopard lizard, *Crotaphytus wislizenii*, and Cowles (1920, p. 64) has reported finding it in the stomach of not only this form, but also in that of the collared lizard, *Crotaphytus collaris*.

Of the snakes, apparently the genera *Mastcophis* and *Crotalus* are the only ones that have been reported as enemies of this lizard, but probably the subspecies is welcome prey to many kinds of snakes. According the Ruthven (1907, p. 563) the whiptail is preyed upon by the red racer, *Masticophis flagellum frenatus*. This statement is supported by Cowles (1920) who wrote that after shooting one of these lizards and while watching for an opportunity to kill it without the use of a second shot, a racer glided into view and seized it. Ruthven and Gaige (1915, p. 26) have said that the desert whiptail is preyed upon by the striped racer, *Masticophis taeniatus taeniatus*. A specimen of *tessellatus* was obtained from the stomach of *Crotalus cerastes* by Van Denburgh and Slevin (1913, p. 429), and it has been claimed to form a part of the food of *Crotalus tigris* (Ortenburger and Ortenburger, 1926, p. 111).

Affinities.—Because of its characters, geographical position and plasticity, *tessellatus* is obviously the stem-form of its group. For reasons to be presented in the general summary at the end of this work (pp. 251–260), it is thought to have been descended (either directly or through *maximus*) from *gularis* of the *sexlineatus* group from which its color pattern may be logically and simply derived, and with which it agrees in all fundamentals of scutellation, excepting for a notable decrease in the average size of the post-antebrachials.

In scutellation it is "almost identical with *sexlineatus*," as stated by Brown (1903, p. 547), but its coloration suggests only certain phrases of *gularis*. In this respect, just why Ellis and Henderson (1913, p. 77) should have written that "The young tessellated lizard is marked much like the adult *sexlineatus*" is not apparent. Strecker (1908, p. 169) has correctly reported that the sides of an adult male of *gularis* may present a barred and mottled appearance as seen in some examples of *tessellatus*. This is at once evident to those working with series from various localities, particularly from western Texas and Chihuahua.

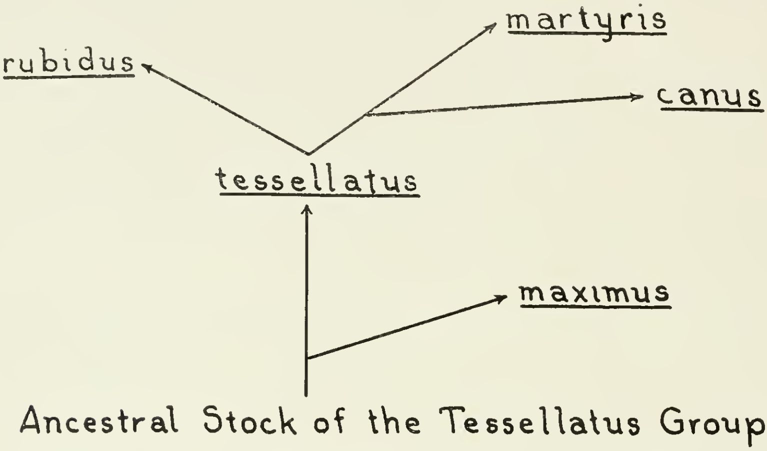

FIGURE 28.—DIAGRAM OF THE SUPPOSED RELATIONSHIPS OF C. TESSELLATUS TESSELLATUS

The large *maximus* is apparently not closely related to the modern *tessellatus*. It is probable that both forms represent a common stock and that they were differentiated before the birth of any of the other known forms of the group. At the southern part of its range in Lower California, *tessellatus* seems to have very recently given rise to *rubidus* with which it now intergrades. In the Gulf of California, the insular subspecies, *martyris* and *canus*, have become distinguishable on very slight, although apparently constant, characters, and their evolution from the parent stock seems to have been comparatively recent. Their relationship with *tessellatus* has been discussed in considerable detail above (see p. 160). A further discussion of the affinities of *tessellatus* is presented in the summary of the *tessellatus* group (pp. 221–226).

The apparent relationships of the parent *tessellatus*, and its derivatives, *canus*, *martyris*, and *rubidus*, are shown by the following diagram (p. 199). The probable affinity with *maximus* is also indicated.

CNEMIDOPHORUS TESSELLATUS RUBIDUS Cope

PINK-TAILED WHIPTAIL

1892. *Cnemidophorus tessellatus rubidus* COPE, Trans. Amer. Philos. Soc., vol. 17, p. 36 (type locality, "Santa Margarita Island," west coast of "Lower California," Mexico; 7 cotypes, U.S.N.M. Nos. 15149–15155, collected by the U. S. Fish Commission); Amer. Nat., vol. 26, 1892, p. 522.—BOULENGER, Zool. Rec. for 1892, vol. 29, "Reptilia," 1893, p. 23.—COPE Amer. Nat., vol. 30, 1896, p. 1017; Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 584.

1895. *Cnemidophorus rubidus* VAN DENBURGH, Proc. Calif. Acad. Sci., ser. 2, vol. 5, p. 126.—BOULENGER, Zool. Rec. for 1895, vol. 32, "Reptilia," 1896, p. 19.—VAN DENBURGH, Proc. Calif. Acad. Sci., ser. 3. vol. 4, 1905, pp. 25–26.—GADOW, Proc. Zool. Soc. London, 1906. p. 371.—VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 4, 1914. p. 145.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., 1917, p. 67.— DICKERSON, Bull. Amer. Mus. Nat. Hist., vol. 41, 1919, p. 477.—VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4. vol. 11, 1921. p. 52.—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 546.—NELSON, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 674.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 73.—SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 15, 1926, p. 205.

1899. *Cnemidophorus grahamii* MOCQUARD. Nouv. Archives du Mus., ser. 4. vol. 1, p. 315, (part).

1903. *Cnemidophorus tesselatus rubidus* GADOW, Proc. Roy. Soc. London, vol. 72, p. 119.

1919. *Cnemidophorus vandenburghi* DICKERSON, Bull. Amer. Mus. Nat. Hist., vol. 41, p. 477 (type locality, "Carmen Island, Gulf of California, Mexico"; type specimen, U. S. N. M. No. 64449, C. H. Townsend. collector).—NELSON, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—SCHMIDT. Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 675.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 74.

Systematic notes.—In describing *rubidus* as a subspecies of *tessellatus* Cope recognized its close similarity to that form. Van Denburgh. however, disregarded this, and (1895) wrote that "Prof. Cope is not followed in the use of a trinomial because no intergradation of this with other forms has been shown."

An examination of the specimens from San Bartolome Bay mentioned by Slevin (1926) as possible intergrades between *tesselatus* and *rubidus* shows them to be much nearer to *tessellatus* than to *rubidus*, for even the specimen said to resemble *rubidus* in the dorsal coloration presents the regular pattern of *rubidus* on only one side and the broken pattern of *tessellatus* on the other. Also, there is no red in the ventral coloration. Therefore, true intergradation is to be expected from a point still farther south.

A more definite kind of approach is apparently seen in two specimens from San Marcos Island which lies in the Gulf of California. In these (C.A.S. Nos. 51597, 50502) the tail is light as in *rubidus*, but yellowish as in *tessellatus*. The dorsal markings are those of *rubidus* rather than those of *tessellatus*. These intergrades seem to mark the northern limit of *rubidus*, for all more northern specimens examined (including those from San Bartolome Bay) are nearer to *tessellatus*.

On the basis of this evidence of intergradation, *rubidus* is here returned to its original subspecific status.

Cnemidophorus vandenburghi, described by Dickerson (1919) from Carmen Island, was apparently based on an irregularity of the dark spots on the body. An examination of the type shows it to be a rather typical young specimen of *rubidus*. The under surface of the tail is red and the transverse element is beginning to be emphasized in the dorsal pattern. Van Denburgh (1922, p. 549), said that "After carefully comparing two specimens from Carmen (*vandenburghi*) and five from Danzante Island (*rubidus*) with two of Cope's original series from Margarita Island (*rubidus*) I believe them to be identical in every respect." This is the final conclusion reached by the writer after an examination of all of the specimens.

Diagnosis.—Specimens of *rubidus* may be distinguished from *tessellatus* by the presence of red or pinkish in the ventral coloration, especially of the tail, and from *celeripes* by the presence of a definite transverse element in the arrangement of the dorsal markings. In *rubidus*, crossbars are early developed and long retained, and the longitudinal dark fields are usually confluent only in the youngest specimens. The dark markings on the sides of the head of *rubidus* are few, usually very light or absent, and often brownish, instead of deep black as in *celeripes*.

Description.—Snout rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars 3–5; supraocular granules variable in position; frontoparietals normally 2; parietals normally 3; occipitals small; anterior gulars moderate, uniform or somewhat enlarged centrally; posterior gulars small, uniform; mesoptychial scales small, median largest, arranged in 4–7 transverse rows.

Body elongate; ventral plates in 8 longitudinal and 30–36 transverse rows; dorsal granules small to moderate; limbs well developed; brachials 4–7; antebrachials 2–5; brachials and antebrachials more or less continuous at a point of contact; postantebrachium with small or slightly enlarged granules; femorals 7–10; tibials 3–5;

femoral pores 17–23; tail elongate, tapering; caudal plates large, oblique, and with rather strong lateral longitudinal keels.

Coloration distinctive; under surfaces suffused with more or less red or pinkish, often dark spotted; gular region sometimes spotted with dusky; temporal region unicolor or with a few dark spots or bars; chest and abdomen never covered by a continuous black suffusion; lower surfaces of tail unspotted, pinkish; upper surface of tail pinkish distally, and often proximally as well; ventral color continued high laterally; dark caudal markings absent, or indistinct and confined to the dorsal and proximal region of the tail; dorsal pattern with a more or less distinct tranverse element, this better developed in adults; crossbars developed everywhere on back in larger specimens; dark dorsal fields broken early, seldom confluent longitudinally or transversely; dark dorsal spots roughly square or rectangular, not noticeably rounded; disregarding crossbars, stripes appear to be nearly uniform in width; round light spots usually absent from the adult.

The dorsal coloration of the young is well shown by three specimens from Danzante Island (C.A.S. Nos. 52146–52148) in which four pale dorsal stripes may be seen. In the interspaces there are rows of black spots which may have a tendency to arrange themselves into transverse as well as longitudinal series. Both the spots and the lines are always more distinct posteriorly and the limbs are white spotted above. The dorsal part of the tail is uniformly olivaceous in the young, but with development it becomes salmon, especially at the tip. The sides of the young specimens are barred, and often more or less striped longitudinally as well. It seems that the character of this cross-barring and striping in the young greatly influences the future color pattern.

In most specimens, especially in adults, the pinkish color is not confined to the caudal region, but is found as a suffusion in the region of the femoral pores, in the preanal region, and even anterior to these parts.

Recently collected adults appear to be strikingly distinct and to one familiar with them they are readily identifiable. (The red or pinkish, however, often fades in preservatives.) Larger adults no longer possess distinct white stripes, but have light brown ones instead. This light brown color becomes increasingly dominant with age, especially anteriorly, and it is evident that eventually this type of change would produce a unicolored light brown lizard. The area of the dark dorsal spots is much reduced in many large examples and in a specimen from Magdalena Island (C.A.S. No. 55896) these spots are small and confined entirely to the posterior third of the back. A further development of this tendency has not been noted.

Data based on 37 specimens of *rubidus*, including its cotypes and the type of *vandenburghi* have been summarized as follows: Body, 48–103 mm.; tail, 128–270; total length, 180–371; length of tail as percentage of total length, 67.2–75.0; width of head, 8.5–16.5; width of head as percentage of body length, 11.8–17.8; hind leg, 33–65; length of hind leg as percentage of body length, 61.0–78.5; frontoparietals 2 in 35 specimens, 3 in 1 specimen, and 4 in 1 specimen; supraocular granules extending forward to the middle of the third supraocular in 30 specimens, to the posterior border of the second supraocular in 6 specimens, and to the middle of the second supraocular in 1 specimen.

The posterior supraocular (fourth) is very small in several specimens, including one (C.A.S. No. 56051) from Santa Margarita Island and one (U.S.N.M. No. 64449) from Carmen Island. The latter specimen is the type of *vandenburghi.*

Range.—*Rubidus* is confined to southern Lower California. Some discussion concerning the range of this form is included under this heading of *celeripes* (p. 204).

The available records are as follows: (*Carmen Island*, Dickerson, 1919, p. 477, U.S.N.M., C.A.S.; *Comondu*, Van Denburgh, 1895, p. 128; *Concepcion Bay*, Van Denburgh, 1922, p. 549, C.A.S.; *Danzante Island*, Van Denburgh, 1922, p. 549, C.A.S.; *Magdalena Island*, Van Denburgh, 1895, p. 128, C.A.S.; *Mulege*, Mocquard, 1899, p. 315; *Santa Margarita Island*, Cope, 1892*c*, p. 36, U.S.N.M., C.A.S.).

Intergrades with *tessellatus* have been found on *San Marcos Island* (Van Denburgh, 1922, p. 549, C.A.S.), and more are to be expected on the mainland somewhere south of here.

Habitat and habits.—Nothing has been published concerning the habitat and habits of this subspecies.

Affinities.—*Rubidus* is obviously closely related to *tessellatus*, from which it is only slightly differentiated, and with which it intergrades in the northern part of its range. Judging from this approach and its peripheral position it is likely that *rubidus* was derived directly from *tessellatus* in recent geological times. A detailed discussion of this relationship will be found under *celeripes* (p. 205).

CNEMIDOPHORUS TESSELLATUS CELERIPES (Dickerson)

SAN JOSE ISLAND WHIPTAIL

1919. *Cnemidophorus celeripes* DICKERSON, Bull. Amer. Mus. Nat. Hist., vol. 41, p. 472 (type locality, "San Jose Island, Gulf of California, Mexico"; type specimen, U.S.N.M. No. 64444, C. H. Townsend, collector).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 549.—NELSON, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 675.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 70.

Diagnosis.—The whiptail of San Jose Island is distinguished from *tessellatus* only by the presence of reddish or pinkish in the ventral coloration,[23] particularly under the tail, and from *rubidus* by a distinctive coloration. The dark temporal markings, although usually brownish and indistinct in *rubidus*, are black and well defined in *celeripes*. Because of a dominance of the ground color of the original dark longitudinal fields, which results from a suppression of cross-barring, the pattern of *celeripes* always gives the general impression of alternate and largely continuous series of longitudinal stripes or chains of black and white spots lying side by side. There are occasional white crossbars in all specimens, especially laterally, but in no case is the number as large as in typical *rubidus* or in most *tessellatus*. In *rubidus* the dark dorsal ground color is usually brownish, instead of black. Unlike *celeripes*, specimens of *rubidus* often show dorsal markings which present a definite transverse as well as a longitudinal arrangement, each dark unit on the back being roughly square or rectangular instead of rounded.

Description.—Snout rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars 4; supraocular granules variable in position; frontoparietals 2; parietals normally 3; anterior gulars moderate, enlarged centrally; posterior gulars small, uniform; mesoptychial scales small, median largest, arranged in 6–8 transverse rows.

Body elongate; ventral plates in 8 longitudinal and 33–37 transverse rows; dorsal granules small; limbs well developed; brachials 4–6; antebrachials 2–4; brachials and antebrachials more or less continuous at a point of contact; postantebrachium with small or slightly enlarged granules; femorals 6–9; tibials 3–4; femoral pores 18–23; tail elongate, tapering; caudal plates large, oblique, with rather weak lateral keels.

Coloration distinctive; under surfaces suffused with more or less reddish or pinkish, often black spotted; gular region usually heavily spotted with black and often crossed by prominent black bars; temporal region with prominent black blotches or bars; chest or abdomen never covered by a continuous black suffusion; lower surface of tail usually unspotted, pinkish; upper surfaces of tail with less pink than *rubidus*, darker, often reticulated with more or less blackish; dorsal pattern predominatingly longitudinal, rather than transverse; cross-bars suppressed dorsally, more numerous on sides, and usually incomplete; black dorsal fields more or less confluent, chainlike, edges undulatory or rounded; original stripes alternately widened and constricted, also chainlike and more or less confluent longitudinally; lower lateral stripes never of even width; young with spots in lateral fields, adults usually without spots.

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[23] The red may become nearly or quite indistinguishable after long preservation.

Even the youngest specimens show stripes of uneven width. The lateral fields bear spots in the young which enlarge and unite with the stripes to form crossbars, but a secondary encroachment of the dark ground color of the fields tends to suppress these bars and to maintain only a longitudinal arrangement of the dorsal markings. Thus, the area where the spot was originally may be secondarily covered by black, the white color having migrated to the stripes. The centers of enlargement in the stripes of aged individuals are formed by either embryonic or juvenile evolution of the color pattern in this manner. In *rubidus*, the cross-bars become dominant at the expense of the dark coloration so that a confluent longitudinal arrangement of the dark fields is not maintained in the adult.

Only nine specimens of *celeripes*, including the type, have been available for this study. The data obtained may be summarized as follows: Body, 68–116 mm.; tail, 210–306; total length, 278–411; length of tail as percentage of total length, 71.5–75.4; width of head, 10–20; width of head as percentage of body length, 13.7–17.2; hind leg, 50–76; length of hind leg as percentage of body length, 61.0–74.5; supraocular granules extending forward to the middle of the third supraocular in two specimens, to the posterior border of the second supraocular in four specimens, and to the middle of the second supraocular in three specimens.

Range.—This form is known only from San Jose Island in the Gulf of California. Dickerson (1919) in the original description stated that "The range probably includes the mainland of Lower California from the Gulf northward from La Paz and San Jose Island. * * * It is probably the species from Santa Rosalia and Mulege, identified by Mocquard (1899) as *Cnemidophorus grahamii* Baird and Girard." Since all of the mainland members of the *tessellatus* group that the writer has examined from this general region are typical *rubidus*, it seems that Dickerson's assumptions were largely theoretical. The nearest approach to the type of dorsal coloration found in *celeripes* is presented by certain specimens of *tessellatus* from distant regions. These latter have the general dorsal pattern of *celeripes*, but they do not have a red or pinkish coloration ventrally. Specimens taken *between* San Jose and San Marcos islands, consisting of both mainland and insular representatives, have proved to be *rubidus*, and not *celeripes*, or *tessellatus*, and intergrades between *rubidus* and *tessellatus* have been found on San Marcos Island. This seems to exclude the possibility of *celeripes* being directly derived from *tessellatus* or of the more northern Santa Rosalia specimens being *celeripes* or *rubidus*. The Santa Rosalia specimens are therefore referred to *tessellatus*. Since the Mulege examples are in the probable range of *rubidus* they are referred to that form, although they may be intergrades between *rubidus* and *tessellatus*.

Thus, the only known locality for *celeripes* seems to be *San Jose Island* (Dickerson, 1919, p. 472, U.S.N.M., A.M.N.H., M.C.Z., C.A.S.).

Habitat and habits.—Information on the habitat and habits of this species is apparently confined to the following statement of Van Denburgh (1922, p. 551) "This rare and very shy form was found in dense brush thickets from the vicinity of the beaches well into the interior of the island."

Affinities.—This whiptail is confined to San Jose Island which is but a short distance from the mainland of Lower California where *rubidus*, apparently its only possible ancestor, is found. *Celeripes* is obviously more closely related to *rubidus* than to *tessellatus* because red or pinkish is found on its ventral surface. The appearance of a darker dorsal color pattern in the brush-inhabiting *celeripes* is probably due to the environment, since the same variation occurs in foothill (or brush-inhabiting) specimens of *tessellatus* as discussed under that form (pp. 154–157, 166).

CNEMIDOPHORUS TESSELLATUS MARTYRIS (Stejneger)

SAN PEDRO MARTIR ISLAND WHIPTAIL

1891. *Cnemidophorus martyris* STEJNEGER, Proc. U. S. Nat. Mus., vol. 14, p. 407 (type locality, "San Pedro Martir Island, Gulf of California, Mexico"; type specimen, U.S.N.M. No. 15620, paratype, U.S.N.M. No. 15621, E. Palmer, collector).—BOULENGER, Zool. Rec. for 1891, vol. 28, "Reptilia," 1892, p. 8.—VAN DENBURGH, Proc. Calif. Acad. Sci., ser. 2, vol. 5, 1895, p. 125.—COPE, Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 584.—GADOW, Proc. Zool. Soc. London, 1906, p. 373.—VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, 1914, p. 147.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., 1917, p. 66.—DICKERSON, Bull. Amer. Mus. Nat. Hist., vol. 41, 1919, p. 474.—VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, 1921, p. 97.—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 538.—NELSON, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 678.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 71.

Systematic notes.—*C. martyris* is here reduced to subspecific rank because the northern form recently discovered on Sal Si Puedes Island and described by Van Denburgh and Slevin (1921*a*) as *canus*, intergrades with it through the population of reticulated racerunners on the geographically intermediate South San Lorenzo Island. Because of the intergradation of *canus* with *tessellatus* through the whiptail of Smith Island, both *canus* and *martyris* are regarded as subspecies of *tessellatus*.

Diagnosis.—This form is distinguished solely by its coloration. The back is always very finely reticulated or unicolor above and on the sides, although the reticulations sometimes tend to break into spots to produce a pattern similar to that found in the closely related southern forms, *bacatus* and *catalinensis*.

Martyris is very close to *canus*, differing from it merely in the possession of a much darker ground color. The lower labials of all of the *martyris* specimens examined are deep brown or black, while those of typical *canus* are colored some shade of light gray, slate or brown. On South San Lorenzo Island there are such perfect intermediates between the two forms that they can not be conscientiously referred to either subspecies. These are discussed in detail under *canus*.

The whiptail of San Pedro Martir Island differs from typical *tessellatus* in its much smaller maximum size, in a relative reduction of the length of the hind limbs, and in the obsolescence or extreme fineness of the dorsal and lateral reticulations. However, it is very closely approached by certain specimens of this form.

Description.—Snout moderately blunt; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars normally 4; supraocular granules not extending forward past the anterior border of the third supraocular; frontoparietals 2; parietals 3; occipitals small, largest anteriorly; anterior gulars moderate, often enlarged centrally; posterior gulars smaller, uniform; mesoptychial scales rather small, in 5–7 transverse rows, median scutes in each row a little larger.

Body moderately elongate; ventral plates in 8 longitudinal and 35–39 transverse rows; dorsal granules small; limbs rather weak, somewhat shortened; brachials 4–6; antebrachials 3–4; brachials and antebrachials more or less continuous at a point of contact; postantebrachials usually not enlarged, often finely granular; femorals 5–8; tibials 3–4; femoral pores 16–20; tail elongate, tapering; caudal plates large, oblique, with rather strong lateral longitudinal keels.

Coloration distinctive; under surfaces usually suffused with much blackish or shiny black; gular region very dark, black or smoky; all caudal surfaces chocolate to black, usually darker below; back and femora unicolor or covered with many fine white spots and reticulations, these often showing a definite transverse arrangement or tiger-barring; usually no indication of longitudinal arrangement in the dorsal markings; dorsal ground color blackish, this often appears as a continuous suffusion from the deep blackish ventral surface below.

A series of 12 specimens of *martyris* (C.A.S. Nos. 50565–50576) exhibits little variation in the dorsal coloration. The dorsal markings in certain specimens (50565, etc.) are coarse and more distinct than they are in certain other specimens (50570–50572). If these animals are but casually observed, there is no indication of a longitudinal arrangement in the dorsal markings, but a close examination sometimes shows a continuous light brown area or a chain of black spots extending longitudinally for some distance. In no case is this developed enough to even approach the condition found normally in *tessellatus*. The entire under surface is blackish in color, the gular region often having numerous small light spots, and white flecks may sometimes appear on the breast, or even on the posterior part of the body, the under surface of the limbs or at the base of the tail. As in the phase of *tessellatus*, described by Cope as *melanostethus*, the black is usually in greater intensity on the breast. The femoral pores are usually very hard to count because of the blackish suffusion which covers the lower surfaces of the hind legs.

Fourteen specimens, including the type and paratype of this subspecies, have been examined, and data taken from them may be summarized as follows: Body, 38–76 mm.; tail, 91–179; total length, 129–250; length of tail as percentage of total length, 70.5–73.0; width of head, 5.5–10.0; width of head as percentage of body length, 12.5–15.8; hind leg, 26.5–47.0; length of hing leg as percentage of body length, 54.0–68.3; supraoculars four in 12 specimens, five in 2 specimens; supraocular granules extending forward to the anterior border of the fourth supraocular in one specimen, to the middle of the third supraocular in 11 specimens, and to the anterior border of the third supraocular in 2 specimens.

Range.—The typical form is confined to the small mass of land in the Gulf of California, Mexico, that is called *San Pedro Martir Island* (Stejneger, 1891, p. 407, U.S.N.M., C.A.S.); but, intergrades with *canus* are found on *South San Lorenzo Island* (Van Denburgh, 1922, p. 541, C.A.S.), to the northward.

Habitat and habits.—The available information on this subject is apparently confined to the following brief statement by Van Denburgh (1922): "These rather rare lizards were found along the rocky slopes of the island. Their very dark coloration caused them to show plainly against the snow white rocks over which they were running."

Affinities.—Cope (1900, p. 584) noted the close relationship of this form with "*melanostethus*," the variant of *tessellatus* with much black inferiorly, from which he supposed it to differ "in the extension of the black over the entire ventral surface." Examination of additional specimens has shown that this distinction is valueless, since many *tessellatus* specimens have as much black ventrally as examples of *martyris*. However, as shown in the diagnosis, there are certain distinctive differences which separate the two forms.

Martyris and its small allies, *canus*, *bacatus*, and *catalinensis*, represent an end development in the evolution of the color pattern of the *tessellatus* group. With their finely reticulated patterns *martyris* and *canus* seem to be decidedly nearer to the coarsely reticulated *tessellatus* than are the profusely spotted forms, *bacatus* and *catalinensis*. The spotted pattern evidently develops from the breaking up of fine light reticulations. The northern *canus* now intergrades with *tessellatus*, its pattern suggesting derivation by a gradual loss of the longitudinal arrangement in the dorsal markings, and *martyris* appears to be merely a melanistic phase of *canus*, with which it now intergrades in an intermediate locality.

A further discussion of the relationships of this section will be included in the summary of the *tessellatus* group (p. 221).

CNEMIDOPHORUS TESSELLATUS CANUS (Van Denburgh and Slevin)

WESTERN RETICULATED WHIPTAIL

1921. *Cnemidophorus canus* VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 97 (type locality, "Sal Si Puedes Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 49153, J. R. Slevin, collector).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 540.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 678.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 70.—SCLATER, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.

Systematic notes.—This lizard is being reduced to subspecific rank here because it has been found to intergrade with *martyris* through the population of reticulated whiptails on the geographically intermediate South San Lorenzo Island, and thence with *tessellatus* through the whiptail on Smith Island.

Diagnosis.—This form is distinguished solely by its coloration. The back is very finely reticulated and the tessellations sometimes show a tendency to break into spots. Also, occasionally the unicolor condition is approached. This species is separated from typical *tessellatus*, and *bacatus* and *catalinensis* in the same way that those species are separated from *martyris*—by the possession of a finely reticulated or unicolor dorsal pattern instead of one with coarse reticulations, lines or spots. It is separated from certain specimens of *tessellatus* only by having relatively finer dorsal reticulations.

Canus is very close to *martyris* from which it differs merely in its much lighter ground color. The lower labials of all of the *canus* specimens examined are light gray, slaty or brown, while those of *martyris* are deep brown or black. Intermediates between the two forms exist on South San Lorenzo Island, as mentioned above, and these are discussed in detail below under the subject of variation (p. 210).

Description.—Snout moderately blunt; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars normally 4; supraocular granules usually not extending forward past the anterior border of the third supraocular; frontoparietals 2; parietals 3; occipitals small, anterior largest; anterior gulars moderate, often nearly uniform in size; posterior gulars small, uniform; mesoptychials rather small, median scutes largest, in 5–7 transverse rows.

Body moderately elongate; ventral plates in 8 longitudinal and 34–37 transverse rows; dorsal granules small; limbs rather weak, somewhat shortened in some specimens; brachials 4–6; antebrachials 2–4; brachials and antebrachials more or less continuous at a point of contact; postantebrachium with small or slightly enlarged granules; femorals 7–9; tibials 3–4; femoral pores 16–20; tail elongate, tapering; caudal plates large, oblique, with rather strong lateral longitudinal keels.

Coloration distinctive; under surfaces usually suffused with more or less bluish, grayish, slate or blackish; gular region often rather light; tail usually unicolor, often grayish above; subcaudal region often uniform deep purplish black; back and femora covered by many small or fine white spots and reticulations, these rarely showing a definite transverse arrangement; usually no indication of longitudinal arrangement in the dorsal markings; dorsal ground color grayish or brownish, usually light.

The specimens of *canus* from North San Lorenzo and Sal Si Puedes Islands are colored and marked dorsally like specimens of *martyris*, with the exception that in *canus* the ground color is much lighter. As in *martyris*, there is some variation in the fineness of the reticulations on the back, and the general ground color is subjected to variation within reasonable limits. The individuals which show a darker or lighter shade dorsally, also exhibit the same chromatic variation ventrally. Although the general series of *canus* looks light while being compared to *martyris*, they are decidedly dark when compared with *sexlineatus*, and this applies even to the lightest specimens. The gular region in most specimens is a uniform slate, but in a few individuals there is a smattering of black spots; the breast is not deep blackish, but always some particular intensity of slate. The abdominal scutes are usually with dark margins, the centers being light in color.

A series of 17 typical specimens has been examined. These were collected on Sal Si Puedes and North San Lorenzo Islands. The data may be summarized as follows: Body, 52–74 mm.; tail, 129–176; total length, 181–242; length of tail as percentage of total length, 71–75; width of head, 7.0–10.5; width of head as percentage of body length, 11.8–15.5; hind leg, 35–50; length of hind leg as percentage of body length, 59–82; supraoculars, 3–4 in 2 specimens, 4 in 15 specimens; supraocular granules extending forward to the middle of the third supraocular in 13 specimens, and to the anterior border of the third supraocular in 4 specimens.

Variation.—A total of 13 intergrades between *canus* and *martyris* were collected by Mr. Slevin on South San Lorenzo Island. Data from these follows: Body, 54–78 mm.; tail, 132–175; total length, 193–248; length of tail as percentage of total length, 68.4–74.5; width of head, 8–12; width of head as percentage of body length, 13.0–15.6; hind leg, 40–53; length of hind leg as percentage of body length, 62–78; supraoculars 4; supraocular granules extending forward to the middle of the third supraocular in 12 specimens, and to the anterior border of the third supraocular in one specimen; femoral pores 17–21.

A comparison of the data given for these intergrades with that presented for typical *canus* and typical *martyris*, especially in regard to the more definite percentage computations, is an excellent means of demonstrating their close relationship. In no case is there a significant divergence in the intermediates from the presumed "normal" of the other two groups.

The 13 specimens from South San Lorenzo Island are exact color intermediates. Four large specimens (C.A.S. Nos. 51262, 51264, 51266, 51269) are identical with *martyris* in coloration, with the exception that the anterior upper labials are light in one (No. 51264). Of the smaller specimens, three have definitely black chests (Nos. 51263, 51265, 51268), but one (No. 51287) has a very light chest. Another specimen (No. 51272) is identical with *canus*. The series as a whole is decidedly darker than *canus*, but distinctly lighter than *martyris*.

Range.—The typical form is confined to two small islands in the Gulf of California. These are *Sal Si Puedes* and *North San Lorenzo* Islands (Van Denburgh and Slevin, 1921*a*, p. 97, C.A.S.). Intergrades with *martyris* are found on *South San Lorenzo Island* (Van Denburgh, 1922, p. 541, C.A.S.).

Habitat and habits.—This species is fairly common on Sal Si Puedes Island according to Van Denburgh (1922, p. 542). Most of the specimens collected were taken under the low-growing shrubs in the bottom of the small arroyos. Their coloration gave them excellent protection, as it blended perfectly with the slate blue rocks which cover the island.

Affinities.—This form is subspecifically allied to both *tessellatus* and *martyris*, and, as indicated above, intermediates between *tessellatus* and *canus*, and between *canus* and *martyris*, have been examined. The transition in each case is but a step. The general relationships of *canus* are the same as those of *martyris* and have been discussed at length under the affinities of that form (p. 207).

Also, a further elaboration of the relationships of these lizards will be found in the summary of the *tessellatus* group (p. 221).

CNEMIDOPHORUS BACATUS Van Denburgh and Slevin

SAN PEDRO NOLASCO ISLAND SPOTTED WHIPTAIL

1921. *Cnemidophorus bacatus* Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 97 (type locality, "San Pedro Nolasco Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 49152, J. R. Slevin, collector). —Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 544.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 625.—Stejneger and Barbour, Check List N.A. Amph. and Rept., ed. 2, 1923, p. 70.—Sclater, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.

Systematic notes.—*Bacatus* and *catalinensis* are apparently very closely related in spite of their splendid geographical isolation from each other, for they represent the same end development of the color pattern of the *tessellatus* group. It is only because of the apparent constancy of their distinctive characteristics and the wide separation of their respective habitats that the two forms are given full specific rank here.

Diagnosis.—The distinctive features of the form are all colorational. *Bacatus* may be separated from the very closely allied *catalinensis* by the possession of fewer, more distinct, dorsal spots, which are white, rather than yellowish. Furthermore, in the region above the level of the tympanum and anterior to the insertion of the forearm, there are no spots or indications of spots, such as are present in *catalinensis*. There are no indications of longitudinal stripes, crossbars, or recticulations in either species, such as those that occur in *martyris*, *canus*, and *tessellatus*.

Bacatus is distinguishable from all other spotted *Cnemidophori* (except *catalinensis*) by its small adult size.

Description.—Snout rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars 4; supraocular granules extending forward to the middle of the third supraocular; frontoparietals 2; parietals 3; occipitals small, irregular, largest anteriorly; anterior gulars moderate, rather uniform, a few enlarged granules medially and mediolaterally; posterior gulars small, uniform; mesoptychial scales moderate, median largest, in 5–7 transverse rows; post-mesoptychial granules on the edge of the collar fold.

Body elongate; ventral plates in 8 longitudinal and 34–36 transverse rows; dorsal granules small; limbs moderately long, well developed; brachials 4–6; antebrachials 2–3; brachials and antebrachials more or less continuous at a point of contact; postantebrachium with a few enlarged granules; femorals 6–8; tibials 3; femoral pores 16–21; tail elongate, tapering; caudal plates large, oblique, and with rather strong lateral longitudinal keels.

Coloration distinctive; under surfaces usually suffused with much blackish; gular region usually slate or smoky; all caudal surfaces brownish, chocolate, or black, usually darker below; base of tail sometimes with light spots laterally, tip dark, blackish; back and upper surfaces of hind legs with numerous small white spots which are very abruptly defined against the general ground color; spots smallest dorsally, largest laterally; sides only slightly suffused with deep black and with occasional white flecks at the ventro-lateral line; spots or indications of spots absent in the region above the level of the tympanum and anterior to the insertion of the forearms.

The femoral pores are often very hard to count because of the black suffusion which usually covers the under surface of the hind limbs.

In young specimens, the characteristic white spots are more numerous and better defined, but unlike those of *catalinensis* of the same age, they do not extend above the level of the tympanum, forward of the insertion of the forearm. On the sides of the neck, however, a few small spots may be seen. In all individuals there is an evident tendency for the spots to disappear anteriorly with age, and in no large specimens are spots present anteior to the forearms. This ontogenetic loss of spots progresses more rapidly along the middorsal line than at the sides.

Only 12 specimens of this species have been available for examination. Their measurements have been summarized as follows: Body, 46–75 mm.; tail, 105–200; total length, 155–275; length of tail as percentage of total length, 65.5–73.0; width of head, 7–10; width of head as percentage of body length, 13.7–16.0; hind leg, 32–50; length of hind leg as percentage of body length, 61.5–74.2; head scales uniform as indicated above.

Range.—This spotted whiptail is confined to *San Pedro Nolasco Island* in the Gulf of California (Van Denburgh and Slevin, 1921*a*, p. 97, C.A.S.).

Habitat and habits.—According to Van Denburgh (1922, p. 546), "this beautiful lizard was not common in its natural habitat. Most of the specimens were found (by Mr. Slevin) around the nests of a colony of brown pelicans, where they were seen catching flies and the numerous insects attracted by dead fish and other refuse. A few were found among the fallen cacti in the deep gullies which run down to the sea coast."

San Pedro Nolasco Island is only 2¼ miles long by three-fourths of a mile wide. It is but a short distance (less than 10 miles) from the mainland of Mexico. Its shores rise abruptly at most points to almost 500 feet and the highest elevation is said to be 1,071 feet. The island itself is a barren, rocky mass of volcanic origin.

Affinities.—This whiptail is closely related to *catalinensis*, to which it is similar in both structure and color pattern. Therefore, it is presumed that *bacatus* and *catalinensis* are derived from a common stock. The pattern of these lizards is merely a slight modification of that of *martyris*, from which this common stock may be assumed to have been derived. A further elaboration of this theory is presented in the summary of the *tessellatus* group (pp. 221–226).

CNEMIDOPHORUS CATALINENSIS Van Denburgh and Slevin

SANTA CATALINA ISLAND SPOTTED WHIPTAIL

1919. *Cnemidophorus disparilis* (part) Dickerson, Bull. Amer. Mus. Nat. Hist., vol. 41, p. 473 (Paratypes, A.M.N.H. Nos. 6884–6885).

1921. *Cnemidophorus catalinensis* Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 396 (type locality, "Santa Catalina Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 50507, J. R. Slevin, collector).—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 542.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 678.— Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 70.—Sclater, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.

Systematic notes.—Concerning *C. disparilis*, Schmidt (1922) wrote as follows: "Two specimens (A.M.N.H. 6884–6885), without other locality than 'Lower California,' referred to *C. disparilis* by Dickerson, almost certainly belong to *catalinensis*." Van Denburgh (1922) expressed the same opinion. At the American Museum of Natural History the writer now finds only one of the above mentioned specimens, No. 6885. This was listed as *C. disparilis* by Dickerson (1919) and must, therefore, be regarded as a paratype of that species. Since, however, the type of *disparilis* is a specimen of *tessellatus*, the former name becomes a synonym of the latter. As to the identification of the paratype, No. 6885, the writer fully agrees with Schmidt and Van Denburgh (and feels that there could have been no mistake regarding No. 6884 as well.

Diagnosis.—The distinctive features of this lizard are all colorational. It is distinguished from the very closely related *bacatus* by a noticeable increase in the number of spots on the back and sides. Moreover, these spots are yellowish, rather than white. In the region above the level of the tympanum and anterior to the insertion of the forearms, spots or indications of spots are absent in *bacatus*, but present in *catalinensis*. There are no indications of cross-barring or longitudinal striping in either species, and even reticulations, such as those found in *martyris* and *canus*, are absent. *Catalinensis* is distinguishable from all of the mainland species of spotted *Cnemidophori* by its small adult size.

Description.—Snout rather blunt; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars usually 3, sometimes 4; supraocular granules not extending forward past the posterior border of the second supraocular; frontoparietals normally 2, sometimes 3; anterior gulars moderate, often uniform, but sometimes with a few enlarged scutes laterally or medially; posterior gulars small, a few median granules slightly enlarged; mesoptychial scales moderate, nearly uniform, in about 7 transverse rows; a series of postmesoptychial granules present on the posterior gular fold.

Body elongate; ventral plates in 8 longitudinal and 32–35 transverse rows; dorsal granules small; limbs moderately long, well developed; brachials 4–6; antebrachials 2; brachials and antebrachials usually continuous at a point of contact; postantebrachium usually with a few enlarged granules; femorals 6–8; tibials 3; femoral pores 15–18; tail elongate, tapering; caudal plates large, oblique, and with rather strong lateral longitudinal keels.

Coloration distinctive; under surfaces usually suffused with much blackish; gular region usually slaty or smoky; tail brownish above, unspotted, and with a blackish tip; back and upper surfaces of hind limbs with rather numerous and obscure small yellowish spots; dorsal ground color usually a moderate deep brownish; pattern spotted, without longitudinal or transverse arrangement; ground color more intense anteriorly; a few distinct light spots in sharp contrast to the deeper blackish of the sides; spots or indications of spots present in the region above the level of the tympanum and anterior to the insertion of the forearms.

In the young the characteristic yellowish spots are more numerous and better defined than in the adult, and they extend from the occipital region (where they are often poorly defined) to the insertion of the tail. The spots seem to grow more and more indistinct with age, but always cover the sides of the back to a significant distance. They appear in front of the forearms, especially on the sides. The coloration of the under surface of the body varies from greenish to black. The color of the gular region is in most cases lighter than that of the chest. The abdominal region of one individual, C.A.S. No. 52330, is covered with numerous more or less well defined light spots on a blackish background, but usually light spots are few or absent.

Only 13 specimens of this form have been examined, and their data may be summarized as follows: Body, 48–80 mm.; tail, 131–190; total length, 179–268; length of tail as percentage of total length, 69.0–73.4; width of head, 7–12; width of head as percentage of body length, 12.8–15.0; hind leg, 33–49; length of hind leg as percentage of body length, 61.3–69.0; frontoparietals, 2 in 11 specimens, 3 in 2 specimens; supraoculars, 3–4 in 2 specimens, 4 in 11 specimens; supraocular granules extending forward to the center of the third supraocular in 12 specimens, to the anterior border of the third supraocular in one specimen.

Range.—This little lizard is known only from *Santa Catalina Island*, Gulf of California, Mexico (Van Denburgh and Slevin, 1921*b*, p. 396, C.A.S., A.M.N.H.).

Habitat and habits.—Information concerning the habitat and habits of *catalinensis* has not been published. The Santa Catalina Island in the Gulf of California is little known. It is only 7½ miles long by 2 miles wide, and the highest elevation is 1,543 feet.

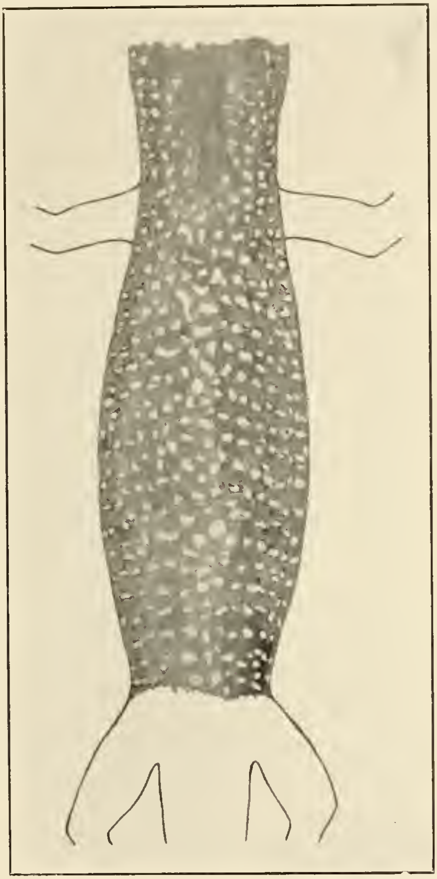

FIGURE 29.—CNEMIDOPHORUS CATALINENSIS. COLOR PATTERN. NOTE THE ABSENCE OF LONGITUDINAL MARKINGS

Affinities.—The present form is very closely related to *bacatus*, from which it may be distinguished chiefly by the character and extent of the dorsal spotting. These two forms represent an end evolution of the *tessellatus* color pattern and may have very well originated from *martyris-canus* stock, which in turn was obviously evolved from the mainland *tessellatus*. Further support of this view is given in the summary of the *tessellatus* group (p. 221).

CNEMIDOPHORUS CERALBENSIS (Van Denburgh and Slevin)

CERALBO ISLAND WHIPTAIL

1921. *Verticaria ceralbensis* Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 396 (type locality, "Ceralbo Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 50510, J. R. Slevin, collector).—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 554.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 679.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 68.—Sclater, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.—Burt, Proc. Biol. Soc. Wash., vol. 42, 1929, pp. 153–154.

Diagnosis.—This species of *Cnemidophorus* is closely allied to *tessellatus* and *rubidus*, from which it differs chiefly in the possession of only a single frontoparietal plate, and in a decided retardation of the process of tessellation. Even the adults have a more or less continuous, though irregular-edged, lower lateral stripe on each side.

Description.—Snout moderately pointed; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars 3; supraocular granules usually extending forward to the center of the third supraocular; frontoparietal entire; parietals 3; occipitals small; anterior gulars moderate to large, graded, and largest centrally; scales of mesoptychium moderately large, largest centrally; scales of mesoptychium moderately large, largest centrally, in 2–4 transverse rows.

Body elongate; ventral plates in 8 longitudinal and 29–34 transverse rows; dorsal granules small; limbs well developed; brachials 5–6; antebrachials 2–3; brachials more or less continuous with antebrachials at a point of contact; postantebrachium with a few slightly enlarged granules; femorals 5–6; tibials 3–5; femoral pores 13–20; tail elongate, tapering, strongly carinated; caudal plates large, oblique, the keels forming distinct longitudinal lines laterally.

Coloration distinctive; ventral aspect similar to that of many specimens of *tessellatus* from the less sandy and more mountainous districts; throat often smoky; under surface of body with many black spots on a whitish or light blue ground color; tail white, yellowish or greenish below, but olivaceous and with or without dark reticulations above; femoral spots white, usually numerous; body with six distinct stripes, four lateral and two dorsal; mid-field often yellowish upon black, giving but a hazy impression of a seventh stripe, but sometimes wide and blackish; width of mid-field variable; other fields usually partly broken by slender, light, transverse bars which extend from the stripes, at least posteriorly; fields blackish and the light transverse bars usually rather finely reticulated, often becoming insensibly lost in the fields.

The evolution and variation of the color pattern of *ceralbensis* is of particular interest. The under parts of the body are always more or less mottled with black and white. The ground color of the upper chest changes from slaty in the young to black in the adult. The mottled chest is often like that of specimens of *tessellatus* from western Nevada and other points, but never like examples of the latter species from southern Arizona, at which place the black of the upper chest of adults is generally unbroken by white spots. The mesoptychium is dark in color, except in very young specimens, and even in the latter a lateral patch of slate is present on each side. The ventral caudal scales often have black centers as do those of *C. tessellatus tessellatus*.

On the sides are two broad, distinct stripes. In the youngest specimens the lower stripe sends out a series of from 14 to 23 narrow white projections into the interspace above and into the black ground below. The pattern remains so, and the projections grow scarcely more or less prominent with the ontogenteic development of the individual, so complete tessellation is never effected. The lower stripe never fades. Often the upper lateral stripe on each side produces bars similar to those of its adjacent lower lateral stripe and in such cases individual bars from the upper lateral stripe, and like bars from the corresponding lower lateral, may unite in the connecting interspace to form a single white bar or passegeway. Bars from the upper lateral stripe usually do not project into the dorsal area, and when they do they are decidedly weaker than the lower ones. Bars are never developed between the two dorsal stripes, but a third stripe often appears there as in *hyperythrus*. This middorsal stripe is often so indistinct that an opinion as to its presence or absence becomes largely a matter of speculation. In other cases the dorsal stripes on each side may approach so closely to the center stripe, and the center stripe may be so diffuse, that all three unite in forming a single dull, yet conspicuous, wide middorsal band of whitish or yellowish hue. Also, in a few instances at least, a broad. light band is formed by the approach and diffusion of the two dorsal stripes when the median stripe is absent, and in other more numerous cases the two dorsals are widely separated and with a distinct blackish band between them. A complete union of the dorsal stripes has not been observed in any of the 103 specimens examined, and evidently a forked dorsal stripe (similar to that of certain specimens of *hyperythrus*) does not appear.

The hind legs of the young specimens are covered with large white spots which become yellowish in adults. The ground color of the femora is always similar to that of the lateral interspaces.

A summary of data from the 103 specimens examined follows: Body, 48–92 mm.; tail, 133–243; total length, 181–331; length of tail as percentage of total length, 71–77; width of head, 7–15; width of head as percentage of body length, 11.9–17.5; hind leg, 32–55; length of hind leg as percentage of body length, 55.5–75.5; front leg, 17–32; frontoparietals 1 in all; supraocular granules extending forward to the center of the third supraocular in 98 specimens, and to the posterior border of the second supraocular in only 5 specimens.

It is rather remarkable that 65 of the lizards (63 per cent) had obviously regenerated tails. The general scutellation of this unique form is unusually constant for a species of *Cnemidophorus.*

Range.—This lizard is found only on *Ceralbo Island* in the Gulf of California, Mexico (Van Denburgh and Slevin, 1921*b*, p. 396, C.A.S., M.C.Z.).

Habitat and habits.—Unfortunately information concerning the habitat distribution of *ceralbensis* is not at present available, and apparently nothing is known about its habits. Ceralbo is a high, barren, volcanic island, 16 miles long and only 4 miles wide. Its highest peaks rise to a height of well over 2,000 feet. There are several narrow sand beaches along the shore line, but the main part of the island is very rocky—and it does not seem unreasonable to expect such an environment to produce or preserve a distinct form. It may be of significance that certain colorational details in *ceralbensis* approach very closely those of the "*stejnegeri* and *grahamii*" (so-called) phases of *tessellatus*, from the rocky, mountainous regions of the west coast and from those of western Texas, respectively, and that in no case is the coloration of specimens of *tessellatus* from the desert basins definitely approached.

Affinities.—The Ceralbo Island whiptail is related to *rubidus* of the adjacent mainland, which is apparently its only possible ancestor. It differs from typical specimens of this supposed parent form only by the presence of a single frontoparietal plate, the normal presence of three supraoculars, and in the possession of a distinctive coloration. A full account of the relationships of these lizards will be found in the summary of the *tessellatus* group (p. 221).

CNEMIDOPHORUS MAXIMUS Cope

GIANT WHIPTAIL LIZARD; LARGARTIJA

1863. *Cnemidophorus maximus* Cope, Proc. Acad. Nat. Sci. Phila., p. 104 (type locality, "Cape St. Lucas, Lower California, Mexico"; type specimen, U.S.N.M. No. 5297, John Xantus, collector); Idem. 1866, p. 312; Bull. U. S. Nat. Mus., no. 1, 1875, p. 45.—Lockington, Amer. Nat., vol. 14, 1880, p. 295.—Yarrow, Bull. U. S. Nat. Mus., no. 24, 1882, p. 42.—Garman, Bull. Essex Inst., vol. 16, 1884, p. 13.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 369.—Cope, Bull. U. S. Nat. Mus., no. 32, 1887, p. 45; Trans. Amer. Philos. Soc., vol. 17, 1892, p. 32.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 5, 1895, p. 122.—COPE, Amer. Nat, vol. 30, 1896, p. 1012.—BOULENGER, Zool. Rec. for 1895, vol. 32, "Reptila," 1896, p. 19.—BELDING, W. Amer. Sci., vol. 3, 1897, p. 97.—COPE, Ann. Rept. U. S. Nat. Mus. for 1898, 1900, p. 570.—GADOW, Proc. Zool. Soc. London, 1906, p. 371.—DITMARS, Reptile Book, 1907, p. 186.—STEJNEGER and BARBOUR, Check List N. Amer. Amph. and Rept., 1917, p. 66.—VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, 1921, p. 62.—TERRON, Mem. Soc. Cient. "Antonio Alzate," vol. 39, 1921, p. 164.—VAN DENBURGH, Occas. Pap Calif. Acad. Sci., vol. 10, 1922, p. 506.—NELSON, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—SCHMIDT, Bull. Amer. Mus. Hist., vol. 46, 1922, p. 677.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 72.

Diagnosis.—This large and distinct species may be distinguished by the following characteristics: Frontoparietals 2; supraoculars normally 4; dorsal ground color rich chestnut brown; throat often with brownish patches or spots; young usually with some bluish in ventral coloration; back with 3 unusually wide, irregular, longitudinal light lines; each side with a similar line in the young, usually also in the adult; size large.

This handsome 5-striped lizard is perhaps the least tessellated form among the members of the *tessellatus* group which show traces of longitudinal arrangement in the dorsal color pattern. It is not closely related to the rest, and is therefore not likely to be confused with them.

Description.—Snout usually rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars normally 4; supraocular granules variable in position; frontoparietals normally 2; parietals normally 3; anterior gulars moderate to large and usually enlarged centrally; posterior gulars small, uniform; mesoptychials variable, usually in 4–6 rows.

Body large, heavy; ventral plates in 8 longitudinal and 32–38 transverse rows; dorsal granules small to moderate, variable; limbs well developed, strong; brachials 4–9; antebrachials 3–6; brachials and antebrachials usually continuous at a point of contact; postantebrachium with small or slightly enlarged granules; femorals 5–9; tibials 3–6; femoral pores 19–27; tail elongate, tapering; caudals large, oblique, and with rather strong lateral longitudinal keels.

Coloration distinctive; ground color of throat variable, usually white or yellowish, and with bluish, black, slate or brownish spots or patches; chest and abdomen usually white or yellowish, but with spots or lines of bluish, black or brown; under surfaces of tail and feet usually white and not with red or pinkish as in *rubidus;* lateral and dorsal part of caudal rings often marked with alternate light and dark transverse areas; femora spotted or reticulated; dorsal ground color usually brownish or rich chestnut; back and sides 5-striped, the lower pair lateral in position; stripes unusually wide, and irregular or wavy in outline; field spots more or less united with stripes in larger specimens, thus increasing the irregularity of their outline; back never with fine reticulations.

A summary of data taken on the 115 available specimens of this species follows: Body, 58–135 mm.; tail, 156–340; total length, 216–470; length of tail as percentage of total length, 67.7–74.0; width of head, 9.0–21.5; width of head as percentage of body length, 11.9–17.3; hind leg, 44–85; length of hind leg as percentage of body length, 63.5–76.0; frontoparietals 1 in 2 specimens, 2 in 112 specimens, and 3 in 1 specimen; supraoculars 4 in 112 specimens and 5 in 3 specimens; supraocular granules extending as far forward as the center of the third supraocular in 37 specimens, to the anterior border of the third supraocular in 67 specimens, to the middle of the second supraocular in 5 specimens, to the anterior border of the second supraocular in 4 specimens, and to the middle of the first supraocular in 1 specimen.

According to the original description (Cope, 1863, p. 104) this species has the collar scales largest at the edge, but an examination of a number of specimens shows that these scales are normally largest medially. Ditmars (1907) was apparently in error in saying that "large adults lose all traces of stripes."

Range.—The giant whiptail occurs in the Cape District of Lower California from Cape San Lucas northward to La Paz Bay, and possibly to Magdalena Bay as well. The availble reports follow: (*Agua Caliente*, Van Denburgh, 1922, p. 508, C.A.S.; *Buena Vista*, Van Denburgh, 1922, p. 508, C.A.S.; *Cape San Lucas*, Schmidt, 1922, p. 677, U.S.N.M., C.A.S.; *Espiritu Santo Island*, Schmidt, 1922, p. 677, U.S.N.M., C.A.S.; *Guamuchil Rancho*, Van Denburgh, 1922, p. 508, C.A.S.; *Isla Partida, near Espiritu Santo Island*, C.A.S.; *La Paz*, Yarrow, 1882, p. 42, U.S.N.M., C.A.S.; *Magdalena Bay*, Lockington, 1880, p. 295; *Miraflores*, Van Denburgh, 1895, p. 125, C.A.S.; *San* Antonio, Van Denburgh, 1922, p. 508, C.A.S.; *San Bartolo*, Van Denburgh, 1922, p. 508, C.A.S.; *San Bernardo Mts.*, Schmidt, 1922, p. 677, U.S.N.M.; *San Jose del Cabo*, Van Denburgh, 1895, p. 125, C.A.S., Stanford; *San Pedro*, C.A.S., M.C.Z., Mich.; *Sierra San Lazaro*, Van Denburgh, 1895, p. 125, Stanford; *Todos Santos*, Van Denburgh, 1922, p. 508, C.A.S.; *Triunfo*, Van Denburgh, 1922, p. 508, C.A.S.).

Habitat and habits.—Very little is known about the habitat and habits of this species. "It was one of the common lizards of the lower levels, but it was not seen at a greater elevation than at Guamuchil Rancho, 1800 feet (Van Denburgh and Slevin, 1921, p. 62). * * * Not always relying on brush for shelter, they often run across large open spaces, depending on their speed to escape an enemy." "This lizard, like others of the genus, is extremely swift when frightened (Van Denburgh, 1922, p. 508). Mr.

Slevin, on several occasions, observed it running on its hind feet only, the front feet being held clear of the ground and the body raised at an angle. One was found, under a pile of brush, holding in its mouth a Verticaria (*C. hyperythrus hyperythrus*) whose skull had been crushed in its powerful jaws."

Enemies.—According to Van Denburgh (1922, p. 508) one of these lizards was removed from the stomach of a red racer, *Masticophis flagellum frenatus.*

Affinities.—Gadow (1906, p. 371) expressed his idea of the relationship of the giant whiptail as follows: "Apparently these specimens from the southern part of Lower California constitute a large, coarsely marbled race of *C. tessellatus.*" The writer agrees, in general, with this conclusion, since representatives of the two forms are geographically adjacent and scutellationally indistinguishable. Moreover, derivation from the small, well differentiated *hyperythrus*, the only other form of *Cnemidophorus* that occurs in the region, seems very unlikely. A discussion of the possible origin and relationships of *maximus* is reserved for the summary of the *tessellatus* group (p. 221) and for the general discussion of relationships at the end of this work (p. 251).

SUMMARY OF THE TESSELLATUS GROUP

The *tessellatus* group is confined to western North America as shown in Figure 30. The various forms of this natural unit, although differing in the maximum size attained, are remarkably uniform in other proportional features and in scutellation. None of the forms has the narrow lateral longitudinal stripes characteristically shown by the young of the *sexlineatus* group.

The *tessellatus* group is composed of 9 forms, 3 mainland representatives, *tessellatus*, *rubidus*, and *maximus*, and 6 island derivatives, *celeripes*, *martyris*, *canus*, *bacatus*, *catalinensis*, and *ceralbensis.* In the selection of the ancestral form of the group, the insular subspecies, all of which are obviously derived from modern mainland types, may be discarded. This leaves only the 3 forms, *rubidus*, *maximus*, and *tessellatus.* The first of these, *rubidus*, now intergrades with *tessellatus* and occupies only a limited range just above the Cape region of Lower California. Derivation of *rubidus* directly from *maximus* of the Cape region or from *hyperythrus*, with which it is coextensively distributed, seems out of the question, but its derivation from *tessellatus* is natural and easy. Therefore, *rubidus* is not considered as prototypical.

There is considerable doubt as to whether *maximus* or *tessellatus* is ancestral, although there can be little doubt of their common origin. The former is confined to the Cape region of Lower California and is well separated, geographically, from the modern *tessellatus* which reaches an extensive development in northern Mexico, the western United States, and northern and central Lower California. Structurally the two are practically identical, but *maximus* is a much larger lizard and retains a more primitive pattern.

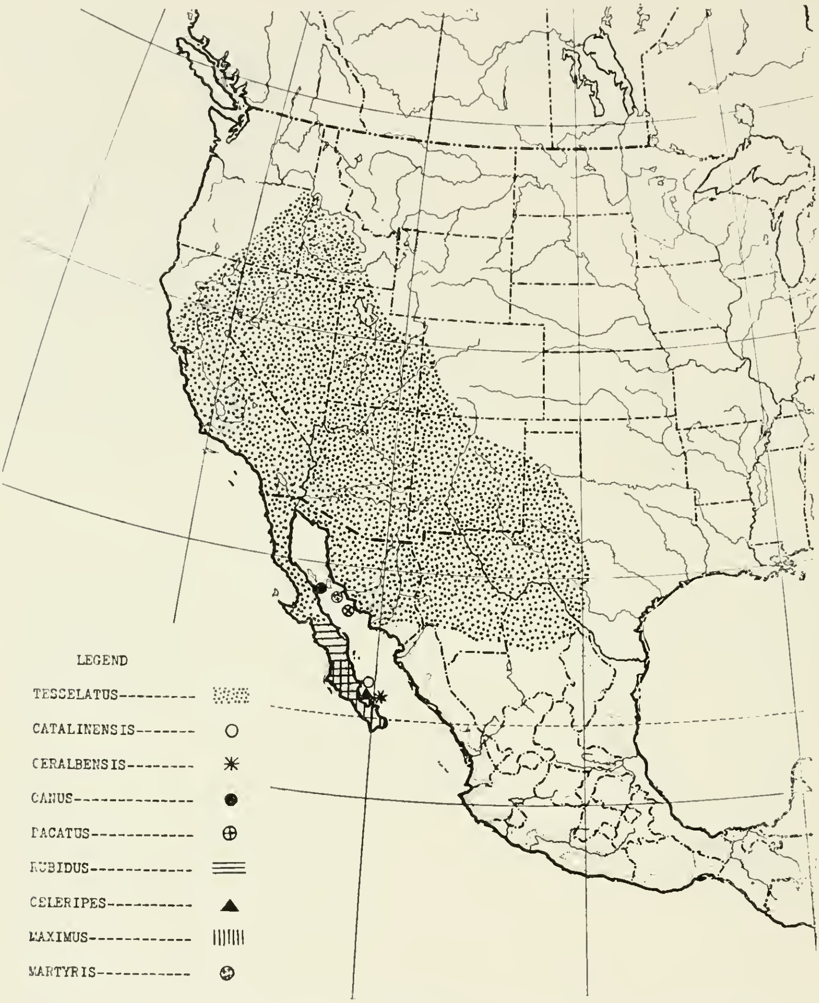
LEGEND
TESSELATUS
CATALINENSIS
CERALBENSIS
CANUS
PACATUS
RUBIDUS
CELERIPES
MAXIMUS
MARTYRIS

FIGURE 30.—MAP SHOWING THE DISTRIBUTION OF THE FORMS OF THE TESSELLATUS GROUP

In relation to the other species of the group *tessellatus* seems unquestionably the prototype, and furthermore, its wide distribution shows it to be a progressive, plastic form. Although it is probable that it rose from *maximus*, which in turn might have risen from *gularis* stock after the separation of southern Lower California from the Mexican mainland, it seems just as logical to assume that both have descended from a common, more northern stock, *tessellatus* representing the most progressive element.

As suggested above, perhaps the earliest form to become differentiated from the proto-stock was *maximus*, which shows a number of the apparently less specialized characters. This form differs from *tessellatus* chiefly in its coloration and in its larger maximum size. The retention of a single, wide, irregular-edged, longitudinal stripe on the lower part of each side in adults and the appearance of bluish in the ventral coloration of the young (both modifications are also seen at times in *tessellatus*) suggest *gularis* of the *sexlineatus* group from which the ancestral stock of the *tessellatus* group is presumed to have been derived.

The time of the derivation of *maximus* (separation from the stock that gave rise to the modern *tessellatus* and its derivatives) is problematical. An extensive submergence of the Lower Californian land mass is thought to have taken place during the post-Pliocene period (see Schmidt, 1922), and this is held to have separated the Cape region from the northern part of the peninsula. Although the last extensive submergence is said to have occurred later, during the post-Pleistocene, *maximus* was probably isolated before this, that is, in the post-Pliocene. This is suggested by its degree of differentiation and its present isolation from the modern *tessellatus*.

A consideration of the group as a whole, and hence of the prototypic forms, *maximus* and *tessellatus*, is to be given in the general discussion at the end of this work (pp. 251–260). The present consideration is therefore limited to the origin and relationships of the seven obvious derivatives from *tessellatus*.

As already indicated, *rubidus* is a subspecies of *tessellatus*, intergrading with that form in the north, along common mainland boundaries and on San Marcos Island. Its range extends southward on the peninsula and the closer neighboring islands to meet and partly overlap the range of *maximus*. Intergradation with *maximus* is not apparent. *Rubidus* differs from *tessellatus* through a significant change in the arrangement of the dorsal markings and in the presence of reddish in the ventral coloration. This slight colorational differentiation of *rubidus* from *tessellatus* and its absence from the more distant islands, at once suggests a comparatively recent derivation, which, in this case, may be assumed to have taken place during the Pleistocene age some time prior to the last extensive submergence of the Lower California mainland. This last geological change then resulted in the isolation of sections of the *rubidus* population on this islands where *rubidus* occurs to-day.

The six forms of the *tessellatus* group that have been found to occur exclusively on islands in the Gulf of California are clearly derivatives from *tessellatus* and *rubidus*. Very shallow soundings, usually less than 40 fathoms, or 240 feet, indicate that Ceralbo and San Jose islands, the home of *ceralbensis* and *celeripes*, respectively, may have been an integral part of the mainland at a comparatively recent date.

The large *ceralbensis* of Ceralbo Island presents more scutellational differentiation from *tessellatus* than any other member of the *tessellatus* group. Its most striking difference is in the possession of one frontoparietal plate instead of two. It has been shown that the more or less perfect fusion of the normally separated frontoparietal plates into a single piece occurs as an abnormality in *tessellatus*, and it is suggested that a population of such variants may have given rise to *ceralbensis*. Since the pattern of *ceralbensis* shows a marked likeness to neither that of the geographically adjacent *maximus* nor the northern *rubidus*, one must look elsewhere for a clue as to its possible ancestral stock. While examining specimens, the resemblance of the coarse, dark, longitudinal, dorsal color pattern of *celeripes* of San Jose Island to that of *ceralbensis* is at once apparent. This suggests the differentiation of *ceralbensis* and *celeripes* from a common stock. Yet, the derivation of one of these from the other seems unlikely, due to the presence of a depth of about 800 feet between the two respective habitats as compared with a shallow of less than 100 feet between each and the mainland near it. The presence of red in the ventral and caudal coloration of *celeripes* shows its close affinity to *rubidus* of the neighboring mainland, although the dorsal color pattern is decidedly different, approaching that of northern specimens of *tessellatus* from the higher levels through a general darkening of the ground color and an emphasis on the longitudinal in the dorsal pattern. With the change to a darker pattern and the probable adaptation to a brushy, rather than to a sandy habitat, the amount of red in the ventral and caudal coloration has noticeably decreased in *celeripes* and it is perhaps but secondarily absent in *ceralbensis*. The influence of the general environment has been shown, in the discussion of *tessellatus* (pp. 154–157, 166), to be great, and the differences between the desert and upland forms here in Lower California seem to be essentially the same as they are in other districts. Therefore, in spite of the superficial distinctness of the color pattern of *ceralbensis* and *celeripes* from *rubidus*, it seems likely that both have been directly derived from that form.

The four remaining insular forms (*canus*, *martyris*, *bacatus*, and *catalinensis*) are alike in that they are all dwarf derivatives of *tessellatus*, presenting a similar variation from it—namely, the loss of a longitudinal arrangement in the dorsal markings and the development of the tendency to possess a finely reticulated or finely spotted pattern. All of these species, but particularly *bacatus* and *catalinensis*, are separated from the mainland of Lower California and Sonora by greater distances and depths than are *ceralbensis* and *celeripes*, and, as might be expected, the variation from *tessellatus* is on the whole more striking.

The subspecies, *canus* of Sal Si Puedes Island and North San Lorenzo Island and *martyris* of San Pedro Martir Island, intergrade with *tessellatus* through the whiptail on Smith Island, to the north of them, and with each other through the form on the geographically intermediate South San Lorenzo Island. The islands on which these populations occur are in a direct line with each other and were no doubt connected in the post-Miocene (as suggested by Gadow, 1905*b*, p. 236, and others) and probably the union continued through the Pliocene and perhaps even into the Pleistocene. The pattern of *martyris* and *canus* differs from that found in a minority of specimens of *tessellatus* only in the finer degree of its reticulation. This and the existence of the intergrades, mentioned above, makes it obvious that both *martyris* and *canus* have been directly derived from *tessellatus*.

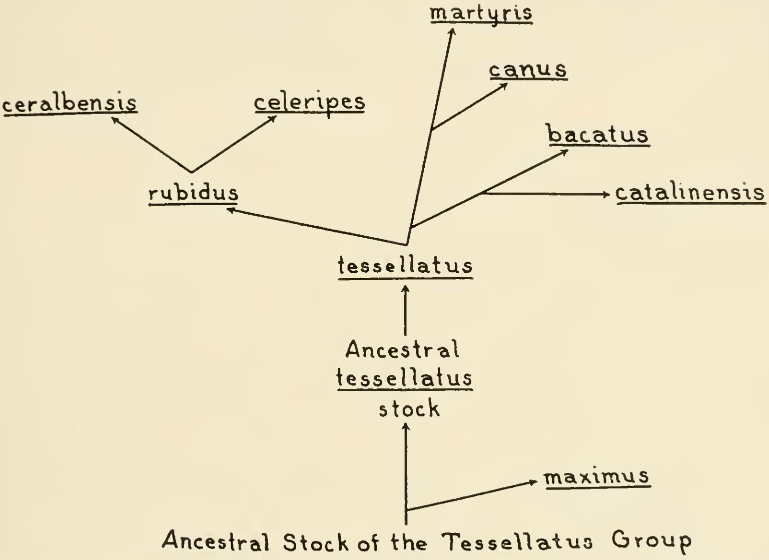

FIGURE 31.—DIAGRAM OF THE SUPPOSED RELATIONSHIPS WITHIN THE TESSELLATUS GROUP

The dwarf species, *bacatus* and *catalinensis*, are not known to intergrade with each other or with either *martyris* or *tessellatus*. Although *bacatus* is found on San Pedro Nolasco Island, near the coast of Sonora, and the latter occurs on Santa Catalina Island, near the Lower Californian mainland, the two forms resemble each other closely. Both are spotted and show no traces of the reticulations that are so characteristic of *martyris* and *canus*. However, it seems probable that their pattern has been derived from that of these reticulated lizards by the breaking apart and concentration of the light pencilings into small distinct spots. Moreover, the pattern and perhaps the geographical position of *bacatus* and *catalinensis* are such as to suggest derivation from *martyris* rather than from *tessellatus*. As to the immediate origin of each, geographical position seems to favor the derivation of *catalinensis* from *bacatus*, although possibly both forms are the remnant of a common stock which may have covered a rather extensive area in what is now the Gulf of California prior to its more complete submergence. It is apparent that active differentiation of these forms from each other has taken place in relatively recent times, probably in the post-Pleistocene.

The writer's interpretations of the genetic relationships within the *tessellatus* group are expressed by the foregoing diagram.

THE HYPERYTHRUS GROUP

CNEMIDOPHORUS HYPERYTHRUS HYPERYTHRUS (Cope)

WESTERN ORANGE-THROATED RACE-RUNNER

1863. *Cnemidophorus hyperythrus* Cope, Proc. Acad. Nat. Sci. Phila., p. 103 (type locality, "Cape St. Lucas, Lower California," Mexico; type specimen, U.S.N.M. No. 5299, John Xantus, collector); Proc. Acad. Nat. Sci. Phila., 1866, p. 312; Proc. Amer. Philos. Soc., vol. 11, 1869, p. 158.—Günther, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—Boulenger, Cat. Liz. British Mus., vol. 2, 1885, p. 371.—Stejneger, Proc. U. S. Nat. Mus., vol. 12, 1890, p. 644.—Boulenger, Proc. Zool. Soc. London, 1898, p. 916.—Mocquard, Nouv. Archives du Mus., Paris, ser. 4, vol. 1, 1899, p. 314.—Gadow, Proc. Zool. Soc. London, 1906, p. 307.—Ditmars, Reptile Book, 1907, p. 185.—Brown, Proc. Acad. Nat. Sci. Phila., 1908, p. 118.

1869. *Verticaria hyperythra* Cope, Proc. Amer. Philos. Soc., vol. 11, p. 158; Bull. U. S. Nat. Mus., no. 1, 1875, p. 46.—Yarrow, Bull. U. S. Nat. Mus., no. 24, 1882, p. 45.—Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 32; Bull. U. S. Nat. Mus., no. 32, 1887, p. 45.—Stejneger, Proc. U. S. Nat. Mus., vol. 17, 1894, pp. 17–18.—Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 5, 1895, pp. 128–130.—Cope, Amer. Nat., vol. 30, 1896, p. 1013.—Boulenger, Zool. Rec. for 1895, vol. 32, "Reptilia," 1896, p. 19.—Belding, W. Amer. Sci., vol. 3, 1879, p. 97.—Cope, Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 563.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, 1921, p. 98.

1884. *Cnemidophorus hyperethra* Garman, Bull. Essex Inst., vol. 16, p. 13.

1894. *Verticaria beldingi* Stejneger, Proc. U. S. Nat. Mus., vol. 17, p. 17 (type locality, "Cerros Island, Lower California," Mexico; type specimen, U.S.N.M. No. 11980, L. Belding, collector).[24]

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[24] As will be seen by the following statements, there has been some uncertainty concerning the type lots of *labialis* and *beldingi*. In answer to the writer's inquiries, Doctor Stejneger, under the date of Feb. 21, 1929, has furnished an account which makes the history of these specimens clear. It may be quoted in full as follows: "(1). In the original record book there was entered during November, 1881 (eight years before I had

1895. *Verticaria hyperythra beldingi* Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 5, p. 131; Idem, 1896, pp. 1005, 1006; Occas. Pap. Calif. Acad. Sci., vol. 5, 1897, p. 141; Proc. Calif. Acad. Sci. ser. 3, vol. 4, 1905, pp. 23, 25; ser. 4, vol. 3, 1912, pp. 150, 152.—Atsatt, Univ. Calif. Publ. in Zool., vol. 12, 1913, p. 40.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 4, 1914, pp. 144–145.—Stejneger and Barbour, Check List N. A. Amph, and Rept., 1917, p. 65.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, 1921, p. 64.—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 560.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 679.—Nelson, Mem. Nat. Acad. Sci., vol. 21, 1922, p. 114.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 69.—Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 15, 1926, p. 205.—Klauber, Bull. Zool. Soc. San Diego, vol. 4, 1928, p. 4.

1898. *Cnemidophorus beldingi* Boulenger, Zool. Rec. for 1897, vol. 34, "Reptilia," p. 20.—Camp, Univ. Calif. Publ. in Zool., vol. 12, 1916, p. 71.

1899. *Cnemidophorus sexlineatus* Mocquard, Nouv. Arch Mus., Paris, ser. 4, vol. 1, p. 315 (No. 20 in species list).—Gadow, Proc. Zool. Soc. London, 1906, p. 302, (San Diego, California).

1900. *Verticaria hyperythra beldingii* Cope, Rep. U. S. Nat. Mus. for 1898, 1900, p. 565.

1917. *Verticaria hyperythra hyperythra* Stejneger and Barbour, Check List N. A. Amph. and Rept., p. 65.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, 1921, p. 63.—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 556.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 679.—Nelson, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—Stejneger and Barbour, Check List. N. A. Amph. and Rept., ed. 2, 1923, p. 69.—Burt, Proc. Biol. Soc. Wash., vol. 42, p. 154.

1917. *Cnemidophorus hyperythrus beldingi* Grinnell and Camp, Univ. Calif. Publ. in Zool., vol. 17, p. 175.—Hall and Grinnell, Proc. Calif. Acad. Sci., ser. 4, vol. 9, 1919, p. 48.—Stephens, Trans. San Diego Soc. Nat. Hist., vol. 3, 1921, p. 63.—Klauber, Bull. Zool. Soc. San Diego, no. 5, 1930, p. 4.

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any connection with the division of reptiles), six specimens under the number 11980. Specimens were at that time numbered by lots and not individually. The latter practice was inaugurated by me when I took charge in 1889. The original entry gives 'Cerros Island' as the locality and 'L. Belding' as the collector. (2). The entry in Yarrow's check list of 1882, p. 45, giving 'La Paz, Lower California,' as the locality for the six specimens, 11980, and the collecting date as February, 1882, is a clerical error. There is nothing in the record book to indicate that this locality is correct, and, as noted, the specimens were already in the Museum in November, 1881. (3). When I overhauled the collection in 1890 I discovered that the six specimens of 11980 from Cerros Island belonged to two different species; the one, which was a true *Verticaria*, was given the original number, 11980; the other five, representing an undescribed species of *Cnemidophorus*, were reentered and given the new individual numbers, 15596–15600, inclusive, No. 15596 being designated as the type; type locality, Cerros Island. (4). In 1894 I discovered that certain specimens of *Verticaria* differed from the typical *V. hyperythra*. I described the new form as *V. beldingi* and designated No. 11980 as the type; type locality, also Cerros Island. (5). Cope's (1900) account was written many years before, apparently before the description of *V. beldingi*, the existence of which was probably overlooked by him. The enumeration of the six specimens as 11980 is only copied from Yarrow's check list with the locality corrected. (6). There is nothing theoretically improbable in *V. hyperythra beldingi* and *C. labialis* living in the same habitat. They are sufficiently distinct for that. It is true that subspecifically distinct forms are not likely to persist as such in the same habitat for any length of time (unless isolated by some physiological barrier), but that 'law' certainly has no application in this case. (7). The fact that these species have not been found on Cerros Island by recent collectors is purely negative evidence. (8). On the other hand I can not guarantee that the original entry is correct as to the locality of Cerros Island, but at the present time I see no reason for doubting it. It is not good practice to exchange one uncertainty for another."

1921. *Verticaria hyperythra schmidti* VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 397 (type locality, "San Marcos Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 50512, J. R. Slevin, collector).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 563.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 680.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 69.—SCLATER, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.

1921. *Verticaria espiritensis* VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 397 (type locality, "Espiritu Santo Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 50511, J. R. Slevin, collector).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 566.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 681.—STEJNEGER and BARBOUR, Check List, N. A. Amph. and Rept., ed. 2, 1923, p. 68.—SCLATER, Zool. Rec. for 1922, vol. 59, 1924, "Reptilia," p. 23.

1921. *Verticaria franciscensis* VAN DENBURGH and SLEVIN, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 397 (type locality, "San Francisco Island, Gulf of California, Mexico"; type specimen, C.A.S. No. 50513, J. R. Slevin, collector).—VAN DENBURGH, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 568.—SCHMIDT, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 681.—STEJNEGER and BARBOUR, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 69.—SCLATER, Zool. Rec. for 1922, vol. 59, 1924, "Reptilia," p. 23.

1929. *Cnemidophorus hyperythrus hyperythrus* BURT, Proc. Biol. Soc. Wash., vol. 42, p. 154.

Systematic notes.—This form was described by Cope (1863) as a species of *Cnemidophorus*, but later (1869) he made it the type of the new genus *Verticaria*. The sole distinction for *Verticaria*, the possession of a single frontoparietal plate, has been found to be inconstant at times (see Burt, 1929), and consequently *V. hyperythra* and the other species of *Verticaria* are being returned to the genus *Cnemidophorus*.

After a study of the variation of *C. hyperythrus hyperythrus*, it seems logical to relegate a number of the forms hitherto recognized to its synonymy. A consideration of these will follow here in the order that they were described.

Verticaria beldingi was described by Stejneger in 1894. Two distinctions were advanced by this author for its recognition. The first was that the scales bordering the gular fold were smaller than those on the chest between the forelegs in the types of *V. beldingi*, while in certain specimens of *V. hyperythra*, with which they were compared, they were found to be the same size as those scales. The failure of this distinction was pointed out by Van Denburgh in 1895, who wrote that "The character originally depended upon for the separation of *V. beldingi* and *V. hyperythra* * * * was found to be valueless, since many of the northern specimens have these scales as large as do specimens from Cape San Lucas, and since much individual variation exists in both. There appears to be not even an average difference, in this respect, between the northern and southern forms." With this view the writer fully concurs.

The second distinction given by Stejneger (1894) was based on the supraocular granules, thus: "I find, moreover, that in 37 of the 40 specimens of *V. hyperythra* from Cape St. Lucas the frontal shield is in contact with the second supraocular and often with the third as well, while in *V. beldingi* the frontal is separated from all of the supraoculars by a complete series of granules." This second discrimination was considered the weaker of the two by Stejneger, because he found the three exceptions in his series of *V. hyperythra* from La Paz, southern Lower California (U.S.N.M. No. 12613). Van Denburgh (1895), on the other hand, emphasizing the importance of the second distinction, gave *beldingi* recognition on this single feature, and presented a table in support of his stand. Data secured from 136 specimens were summarized in the table, and it was shown that in these morphological intergradation existed. Calculation indicates that it was only 8 per cent. Because of this "intergradation," Van Denburgh reduced *V. beldingi* from specific to subspecific rank, and it has remained there ever since.

Later the same author (Van Denburgh, 1922, p. 559) presented a more significant table, which was based on data taken from 332 specimens, 266 of *V. hyperythra* and 66 of *V. beldingi*. Of these, 65 specimens of *hyperythra* are found to present the morphological condition supposedly characteristic of *beldingi*, and 5 specimens of *beldingi* show the condition attributed to *hyperythra*. Calculation from Van Denburgh's figures shows that with the increased numbers of specimens examined the known percentage of variational overlap was advanced to over 21 per cent. Thus, Stejneger's second character distinction was shown to be even more unreliable than was at first supposed. The examination of numerous specimens shows that the supraocular granulation is relatively constant in some widely separated localities but highly variable in others. The collection of more of these small lizards may change the known percentage of morphological overlap between the northern and southern forms, but it can scarcely be expected to do away with it entirely. Therefore, since inconstancy in the variation of the distinctive characters is not confined to a point or line of contact between the two diverging populations concerned, it seems impractical to retain them longer as distinct units. Additional data bearing upon the above subject may be found below in the discussion of variation.

While examining type specimens of *Cnemidophorus* at the United States National Museum, the writer found one, No. 64252, which Miss Mary C. Dickerson intended to make the type of a new subspecies of *C. hyperythrus*. Her manuscript has never been published and doubtless never will be. The specimen was collected by C. H. Townsend at Castro Rancho in the region of Concepcion Bay on the east coast of the mainland of Lower California on April 5, 1911. It was sent to the American Museum with other specimens of the "Albatross" Expedition and catalogued as A.M.N.H. No. 5525. The specimen is in excellent condition, and shows the "*schmidti*" type of coloration (described below). The dorsal line is less intense than the lateral stripes and all of the interspaces are blackish brown. In the writer's opinion this specimen does not differ from many typical individuals of *hyperythrus.*

In a short paper by Van Denburgh and Slevin (1921*b*, p. 397) three new Lower Californian forms of *Verticaria* were diagnosed (*V. hyperythra schmidti*, *V. espiritensis*, and *V. franciscensis*). All three apparently differed from both *hyperythra* and *beldingi*, which are regarded as synonyms here, in but a single feature—the more or less complete union of the dorsal stripes into a single line. Both of the groups under consideration are otherwise alike in all fundamental characters of scutellation and coloration. The union of the dorsal stripes progresses forward from behind as a rule, although some specimens have both anterior and posterior forks. This forking not only suggests derivation from the 2-lined condition found in other specimens (*hyperythrus*), but its variability makes it possible to actually demonstrate *progressive transition* from one extreme to the other.

Specimens of both of the types under consideration (single and multiple lined) have been taken in collections from the following localities:

CALIFORNIA.—Riverside County (*Near Morino*, U.S.N.M.; *San Jacinto*, Stanford). San Bernardino County (*Reche Canyon*, M.V.Z.U.C.). San Diego County (*Oak Grove*, Stanford; *San Diego*, U.S.N.M., M.C.Z.).

LOWER CALIFORNIA.—Northern district (*Las Cabras*, C.A.S.; *Ensenada*, C.A.S.; *2 miles east of Ensenada*, C.A.S.; *San Quentin*, C.A.S.; *San Telmo*, C.A.S.; *6 miles east of San Telmo*, C.A.S.; *between San Vincente and Salado*, Stanford). Central district (*San Ignacio*, M.V.Z.U.C.). Cape District (*La Paz*, U.S.N.M.; *Magdalena Bay*, C.A.S.; *Magdalena Island*, C.A.S.; *Pichilinque Bay*, U.S.N.M.; *Puerto Escondido*, C.A.S.; *San Evaristo*, C.A.S.).

The rather frequent appearance of specimens with a single dorsal line and those with two or three dorsal lines in one place has made it impossible to recognize any subspecies on this kind of character.

V. hyperythra schmidti was said to have the supraoculars normally four. In the collection of the California Academy of Sciences (62 specimens, identified by Doctor Van Denburgh as *schmidti*) over 16 per cent have three supraoculars, and one specimen was found which had three supraoculars on one side and four on the other. Also, the second supraocular was said to be usually without granules in *schmidti.* Five exceptions were found in Van Denburgh's series, mentioned above, and others have been seen elsewhere. The forking of the single dorsal line was presumed to take place farther back in *schmidti* than in *beldingi* (and one might add *V. hyperythra hyperythra* as well). Of the specimens referred to *schmidti* by Van Denburgh, five do not have a forked dorsal stripe. The length of the anterior fork of the other 56 specimens was measured and computed as a percentage of the total length of the entire dorsal line, fork and all, and thus the range of variation in the dorsal forking (of Van Denburgh and Slevin's more or less carefully selected specimens) is found to be from 10.6 to 40.5 per cent. In "*hyperyhtrus*" from the Cape and Central Districts of Lower California this range extends from 9.1 to 90 per cent, and in "*beldingi*" from the northern district of Lower California and from various localities in southern California it extends from 14.3 to 89 per cent. A comparison of these figures shows how futile it is to recognize *schmidti* as distinct on the character of the middorsal line and its percentage of forking. The following quotation from Van Denburgh (1922, p. 556) indicates that he was much perplexed by the variation that he observed in these lizards: "Of 14 specimens from Puerto Escondido, nine are typical *V. hyperythra schmidti*, while five have two dorsal lines. Therefore, it is probable that this species intergrades in the south with *V. hyperythra hyperythra*, as it does in the north with *V. hyperythra beldingi*. The relations of these three forms are not yet clear for *V. hyperythra beldingi*, taken near the northern limit of its range in California, where it cannot be considered as intergrading with *V. hyperythra schmidti*, may have a single dorsal line." Schmidt (1922, p. 680) likewise admitted his confusion over the situation as he found it. His statements are as follows: "As far as I can discover, the specimens before me with the *sericea* color pattern,[25] or with a pattern intermediate between that of *sericea* and *hyperythra* are not structurally distinguishable from *V. hyperythra beldingi;* and the color pattern itself is not firmly fixed, although it appears in the majority of specimens before me. . . . My conception of *V. hyperythra schmidti*, therefore allows for the appearance of a minority of specimens colored like the form from which I believe it to be directly derived or in the process of derivation."

The diagnosis of *V. espiritensis* stated that the supraoculars are normally 3. An examination of all of the available topotypes, 9 in number, shows that 7 of these are "normal" and that 2 have 4 supraoculars. The second supraocular was said to be usually in contact with the frontal. It is found to be in contact with the frontal in 7 specimens and not in 2, one of which is the type. That *V.*

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[25] This must not be interpreted literally in the same sense as set forth in this work under *C. hyperythrus danheimae* (= *V. sericea*). It merely refers to the possession of a single dorsal line, which may be forked for a greater or lesser distance anteriorly.

espiritensis is very close to the typical *C. hyperythrus hyperythrus* was observed by Van Denburgh (1922, p. 568), who remarked that "The single dorsal line and three supraoculars cause this species to resemble most of the other island Verticarias. The coloration of this line, the orange suffusion of the throat, and the large scales at the edge of the collar,[26] show its relationship to *V. hyperythra hyperythra.* It lacks the red coloration of *V. sericea* and *V. caerulea*, rarely having a little rufous laterally, as in *V. franciscensis*."

In the original description of *V. franciscensis* it was said that the supraoculars are normally 3. Examination of the 17 available topotypes reveals only two exceptions. One specimen has 4 supraoculars on both sides; and another, the type, has 3 on one side and 4 on the other. A higher percentage in the frequency of occurrence of three supraoculars in the island specimens is not in itself diagnostic because this is such a common feature in the mainland examples as well. This same general statement may be made in regard to the distinction, "Second supraocular usually in contact with frontal." Moreover, both from the standpoint of their geographical location and from that of their coloration, these specimens stand as intermediates between *C. hyperythrus hyperythrus* and *C. hyperythrus danheimae.* They are, however, very close to the former, and this conception may be gained from a careful study of the statements made by Van Denburgh (1922, p. 570), namely, that "This lizard is most closely related to *V. sericea* [27] of San Jose Island. It differs from that species in the almost complete absence of red on the sides of the body, and in the frequent posterior forking of the dorsal line."

Diagnosis.—The lateral stripes of this form are found to be four in number and are always distinct, the size is always small, the frontoparietal plate is normally entire, and the general appearance of the body suggests weakness, rather than strength. *Hyperythrus* may often be distinguished from *danheimae* and *caeruleus* by the presence of more than one dorsal stripe, and apparently always by the lesser intensity and usually lesser width of the dorsal stripe or stripes as compared to the lateral stripes. There is an emphasis upon brownish, blackish, or grayish in the general coloration, rather than upon reddish as in the subspecies, *danheimae* and *caeruleus.* The ground color of the back is not abruptly darker than that of the sides (this is unlike the condition found in *danheimae*), and the appearance of from one to three more or less distinct, dorsal stripes readily separates it from *pictus*, which usually has no stripes at all.

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[26] It is interesting to note that Van Denburgh in an earlier paper (1895) showed this character to be unreliable in separating *V. beldingi* from *V. hyperythra.*

[27] This statement tends to obscure the true relationship with *hyperythrus.* San Francisco is a small island lying between the mainland and San Jose Island, the home of *danheimae* (= *V. sericea*). It will be noted that the differences pointed out by Van Denburgh are all from *sericea* and *not* from *hyperythrus.*

Description.—Snout only moderately pointed; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraocular usually 3 or 4, rarely 5; granules extending for a greater or lesser distance between the supraoculars and the median head plates; frontoparietal normally entire; parietals 3; occipitals more or less regularly arranged, if in two rows, posterior smaller; anterior gulars moderate to large, graded and usually decidedly largest centrally; posterior gulars small, granular; scales of mesoptychium often large, these may or may not be largest centrally, often uniform in size; mesoptychial scales arranged in 3–5 rows; postmesoptychial granules usually hid beneath edge of fold.

Body elongate; ventral plates in 8 longitudinal and 26–35 transverse rows; dorsal granules small. Limbs moderately well developed, often weak in appearance; brachials 4–6; antebrachials 2–3; brachials more or less continuous with antebrachials at a point of contact; postantebrachium with a few slightly enlarged granules; femorals 4–6; tibials 2–4; femoral pores 12–22. Tail relatively fragile, elongate, tapering; caudal plates large, oblique, and with only moderately strong longitudinal keels laterally.

Coloration distinctive, relatively fixed from young to adult; ventral and caudal aspect similar to that of *caeruleus* and *danheimae;* throat usually orange colored in males, duller in females, often slaty or bluish; ventral parts of body and tail usually suffused with more or less pinkish or bluish of a light hue; anal region and under surfaces of appendages lighter; tail lined laterally and often dorsally for some distance from base; femur striped behind, often reticulated or lined above, but never covered with round spots; back with from one to three dorsal lines; sides with two lines each, these relatively wider and more distinct than dorsal stripe or stripes; ground color or body brownish, grayish, or blackish, but not reddish; field between lateral stripes not abruptly lighter or darker than the ground color of the wide dorsal region between the upper lateral stripes; spots absent from all fields.

Variation.—A total of 566 specimens have been examined. Since there is the possibility that someone might wish to reconsider the relationships of the forms described by Van Denburgh and Slevin as *espiritensis*, *franciscensis*, and *schmidti*, data pertaining to each will be presented here in separate paragraphs, prior to the consideration of the other specimens of *hyperythrus*.

Only nine specimens of "*espiritensis*" from Espiritu Santo Island, off the east coast of the Cape District of Lower California, have been examined. A summary of the data taken from them follows: Body, 51–62 mm.; tail, 142–186; total length, 192–248; length of tail as percentage of total length, 72.3–75.1; width of head, 7.0–9.1; width of head as percentage of body length, 12.5–15.5; hind leg, 31–43; length of hind leg as percentage of body length, 59.6–75.0; femoral pores 15–19; supraoculars, three in 7 specimens, 3–4 in one specimen, and 4 in one specimen; supraocular granules extending forward to the center of the third supraocular in one specimen, to the posterior border of the second supraocular in six specimens, and to the anterior border of the second supraocular in two specimens; single dorsal stripe forked anteriorly in all; variation in percentage of forking, 12.5 to 49 per cent of total length of stripe, including fork.

Seventeen specimens of "*franciscensis*" from San Francisco Island, east coast of the Cape District of Lower California, have been seen, and their data may be summarized as follows: Body, 49–63 mm; tail, 140–190; total length, 192–229; length of tail as percentage of total length, 72.5–75.0; width of head, 6.5–9.0; width of head as percentage of body length, 12.5–15.3; hind leg, 32–41; length of hind leg as percentage of body length, 63.5–75.5; femoral pores, 12–18; supraoculars, 3 in 15 specimens, 3–4 in 1 specimen, and 4 in 1 specimen; supraocular granules extending forward to the center of the third supraocular in 14 specimens, to the posterior border of the second supraocular in 3 specimens; a single dorsal stripe, forked anteriorly, in all; variation in percentage of forking, 4.4 to 22.8 per cent.

The 62 specimens in the collection of the California Academy of Sciences identified by Van Denburgh as "*schmidti*" are all from Lower California, and are chiefly from the east coast of the upper part of the Cape District, the east coast of the Central District, and the neighboring islands of Coronados and San Marcos. The following data are presented to show the variation in this series: Body, 47–63 mm; tail, 130–182; total length, 182–245; length of tail as percentage of total length, 72.5–76; width of head, 6–9; width of head as percentage of body length, 12.0–15.5; hind leg, 33–45; length of hind leg as percentage of body length, 63.0–84.7; femoral pores, 14–19; frontoparietal plate single in 59 specimens, double in 2; supraoculars 3 in 10 specimens, 3–4 in 1 specimen, and 4 in 51 specimens; supraocular granules extending forward to the anterior border of the fourth supraocular in 1 specimen, to the middle of the third supraocular in 28 specimens, to the posterior border of the second supraocular in 28 specimens, to the middle of the second supraocular in 3 specimens, and to the anterior border of the second supraocular in 2 specimens; dorsal stripes 2, separated and unforked, in 8 specimens, two united into a single line behind and forked anteriorly in 54 specimens; variation in percentage of forking, 10.6 to 45.0 per cent.

A total of 449 specimens of *C. hyperythrus hyperythrus*, besides those discussed above, have been measured. For the sake of convenience in showing the futility of recognizing those from the cape district and the southern part of the central district (290 specimens), which were hitherto considered as the true *hyperythrus*, as distinct from those from southern California and the northern part of Lower California (159 specimens), which have been hitherto recognized as "*beldingi*," the data are divided into two parts, constituting a "southern section" and a "northern section."

The following table has been prepared to show the variation in the number of supraoculars and the position of the supraocular granules in specimens from the two regions. It shows that it is impossible to draw a distinction between the two populations on these characters.

Table showing the variation in the number of supraoculars and the position of the supraocular granules in C. hyperythrus hyperythrus

No.	Supraoculars		Position [1]	Supraocular granules	
	South, specimens	North, specimens		South, specimens	North, specimens
3	71	33	pt. 4	7	4
3–4	39	26	4	107	33
4	187	100	pt. 3	108	10
4–5	2	--------	3	32	80
5	1	--------	pt. 2	36	34

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[1] Abbreviations used to represent the forward extent of the supraocular granules in the various specimens are as follows: pt., part; pt. 4, to the middle of the fourth supraocular; 4, to the anterior border of the fourth supraocular; pt. 3, to the middle of the third supraocular; 3, to the anterior border of the third supraocular; and pt. 2, to the middle of the second supraocular.

Van Denburgh (1922) says that "*V. hyperythra hyperythra* has three or two dorsal lines; *V. hyperythra beldingi* normally two, rarely three or one." This distinction has led to the counting of the dorsal stripes on all specimens examined, and the data secured may be summarized by the following table:

Table showing the variation in the number of dorsal stripes of C. hyperythrus hyperythrus

Number of stripes	South, number of specimens	North, number of specimens
1	14	46
2	192	104
3	84	9

The above table not only shows that *V. hyperythra hyperythra* (south) may have "three or two dorsal lines," but that it may also have one. It has already been shown that such 1-lined variants are identical with the suppposedly distinct form, *schmidti*. In addition the table shows that the northern specimens (*beldingi*) usually (scarcely "normally") have two lines and rarely have three. It also fails to verify Van Denburgh's statement that there is rarely one stripe in *beldingi*, but in all fairness it must be recognized that his view was expressed at a time when such variants were referred to *schmidti* whenever possible. If specimens of *schmidti* (discussed above) had furnished additional data for the above table it would be found that the appearance of one stripe in the southern group would be greatly increased.

Variation has been recorded in regard to the condition of the scutellation of the frontoparietal area of the 449 specimens under consideration. In 443 specimens the frontoparietal scute was entire, in 2 it was partly divided by a median longitudinal suture, in 3 it was completely divided into two parts by a median longitudinal suture, and in 1 it was divided into three parts by two irregular sutures.

A few rare and interesting variations and abnormalities have been noted in the material examined. The parietals were found to be almost invariably three in number, but one example (C.A.S. No. 46869) has four parietals, the interparietal having been crossed by a median longitudinal suture. In C.A.S. No. 8550 the frontoparietal shield is united with the interparietal. Two individuals from La Paz, which are from a series bearing the U.S.N.M. No. 12623, show a tendency toward the union of the dorsal stripes into a single line. In one the two stripes meet and separate several times, apparently at will, and in the other there are prominent anterior and posterior forks. In C.A.S. No. 46853 from the same locality the two faint dorsal lines lie side by side and give the appearance of a single, dull, middorsal streak. In three C.A.S. specimens, No. 46978 from San Jose del Cabo, No. 46864 from La Paz, and No. 20955 from San Telmo, the back is unstriped posterior to the insertion of the forearm, but in these there are traces of the usual two dorsal stripes anteriorly, and the lateral stripes are discernable. A single representative from San Jacinto, Calif. (U.S.N.M. No. 21517) has a dorsal stripe which is of about the same width and intensity as the lateral stripes, but has the characteristic brownish ground color of the subspecies.

Range.—This race runner occurs from southwestern San Bernardino County in southern California, southward on the entire peninsula of Lower California. It inhabits many of the closer

Lower Californian Islands. In the United States it has not been found north or east of the San Bernardino Range of mountains.

In California, this race runner has been taken as follows: Riverside County (*Beaumont*, M.V.Z.U.C.; *5 miles east of Elsinore*, C.A.S.; *Gilman Springs*, U.S.N.M.; *5 miles west of Hemet*, C.A.S.; *Morino*, Van Denburgh, 1922, p. 562, U.S.N.M.; *between Oceanside and San Jacinto*, Van Denburgh, 1922, p. 562; *Riverside*, Van Denburgh, 1922, p. 562, M.V.Z.U.C.; *San Jacinto*, Stejneger, 1894, p. 17, U.S.N.M., Stanford; *Temescal Mts.*, Van Denburgh, 1922, p. 562, Stanford; *Vallevista*, Atsatt, 1913, p. 40, M.V.Z.U.C.). San Bernardino County (*Reche Canyon, near Colton*, Atsatt, 1913, p. 40, M.V.Z.U.C.). San Diego County (*Bonsall*, Klauber[28]; *Chollas Heights*, San Diego Soc. Nat. Hist.; *Cottonwood Canyon*, Stanford; *Delmar*, C.A.S.; *Dulzura*, Van Denburgh, 1922, p. 562; *Escondido*, Van Denburgh, 1922, p. 562, M.V.Z.U.C., Baylor; *Jamacha*, Klauber; *Jamul*, Burt, Mich.; *Japatul*, Klauber; *Mexican border between Campo and the coast*, Van Denburgh, 1922, p. 562; *Oak Grove*, Van Denburgh, 1912, p. 152, Stanford; *mouth of Peterson Canyon*, C.A.S.; *Point Loma*, San Diego Soc. Nat. Hist.; *Poway Corners*, Van Denburgh, 1922, p. 562, C.A.S.; *5 miles south of Rainbow*, Klauber[28]; *Ramona*, Klauber; *San Diego*, Cope, 1883, p. 32, M.C.Z., U.S.N.M.,

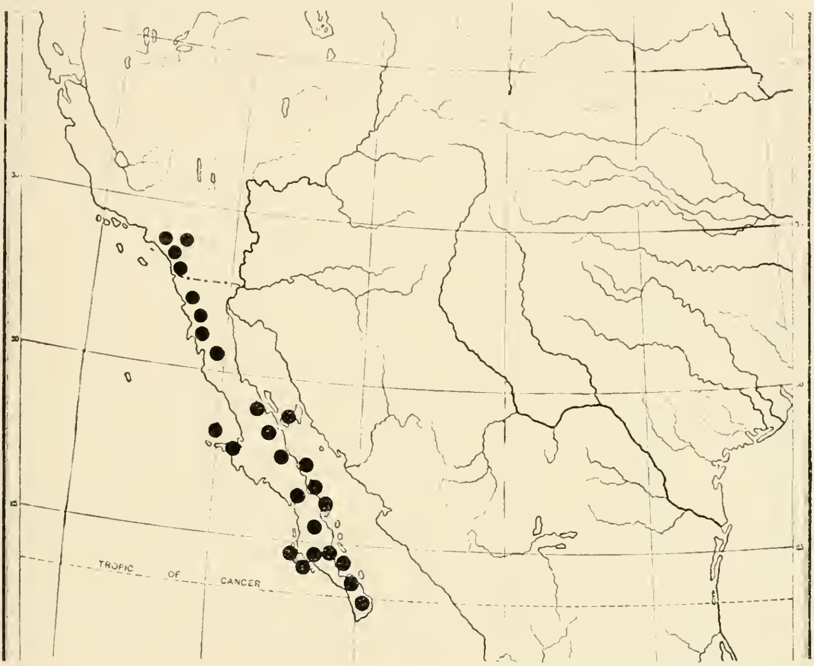

FIGURE 32.—MAP SHOWING LOCALITY RECORDS FOR CNEMIDOPHORUS HYPERYTHRUS HYPERYTHRUS

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[28] Personal reports from L. M. Klauber that are not backed by specimens seen by the writer, but are considered reliable.

San Diego Soc. Nat. Hist.; *Rincon*, Klauber[28]; *San Pasqual*, Klauber[28]; *Tecate*, Klauber[28]; *Twinoak*, U.S.N.M.).

Lower California has been divided into three rather arbitrary districts for the purpose of the presentation of the locality records, thus making it easier for users of this work to locate the points mentioned. In view of the extensive stretch of the peninsula in the north and south direction, the division has been made as follows: (1) A northern district, (2) a central district, and (3) a southern or cape district. The available reports are listed below.

Northern district (*Agua Caliente*, C.A.S.; *Aguas Escondido*, Van Denburgh, 1922, p. 565, F.M.N.H.; *Ensenada*, Van Denburgh, 1896, p. 1006. U.S.N.M., C.A.S., Stanford; *2 miles east of Ensenada*, C.A.S.; *7 miles south of Ensenada*, C.A.S.; *17 miles south of Ensenada*, C.A.S.; *21 miles south of Ensenada*, C.A.S.; *Las Cabras*, C.A.S.; *Rosarito*, Van Denburgh, 1922, p. 565, F.M.N.H.; *San Antonio*, Van Denburgh, 1922, p, 565. F.M.N.H.; *San Quentin*, C.A.S.; *San Salado*, Van Denburgh, 1922, p. 565, F.M.N.H.; *San Telmo*, Van Denburgh, 1896, p. 1006, C.A.S.; *6 miles east of San Telmo*, C.A.S.; *Santo Domingo*, C.A.S.; *between San Vincente and San Salado*, Van Denburgh, 1922, p. 1006, Stanford). Central district (*Angeles Bay*, Van Denburgh, 1922, p. 565; *Cerros Island, west coast*, Stejneger, 1894, p. 17, U.S.N.M.; *Las Animas Bay*, Van Denburgh, 1922, p. 565, C.A.S.; *San Bartolome Bay*, Van Denburgh, 1922, p. 558, C.A.S.; *San Fernando*, U.S.N.M.; *San Francisquito Bay*, Van Denburgh, 1922, p. 565, U.S.N.M., C.A.S., M.C.Z.; *San Ignacio at 500 feet*, Van Denburgh, 1922, p. 562, M.V.Z.U.C.; *Santa Rosalia*, Mocquard, 1899, p. 314). Cape district (*Agua Verde Bay*, Van Denburgh, 1922, p. 565; *Buena Vista*, Van Denburgh, 1922, p. 558, C.A.S.; *Cape San Lucas*, Stejneger, 1894, p. 17, U.S.N.M., C.A.S.; *Castro Rancho, Concepcion Bay*, U.S.N.M.; *Concepcion Bay*, Van Denburgh, 1922, p. 565, C.A.S.; *Coronados Island, east coast*, Van Denburgh, 1922, p. 565, C.A.S.; *Espiritu Santo Island, east coast*, Van Denburgh and Slevin, 1921*b*, p. 397, C.A.S.; *Guamichil Rancho*, C.A.S.; *Isla Partida, near Espiritu Santo Island*, Van Denburgh, 1922, p. 568, C.A.S.; *La Paz*, Stejneger, 1894, p. 17, U.S.N.M., C.A.S., Baylor; *Magdalena Bay*, C.A.S.; *Magdalena Island, west coast*, Stejneger, 1895, p. 132, U.S.N.M., C.A.S.; *Miraflores*, Stejneger, 1895, p. 130, U.S.N.M.; *Mulege*, Stejneger, 1895, p. 565, C.A.S.; *Pichlinque Bay*, Schmidt, 1922, p. 679, U.S.N.M.; *Point Santa Antonita, San Nicolas Bay*, C.A.S.; *Puerto Escondido*, Van Denburgh, 1922, p. 565, C.A.S.; *Rancho Viejo, 10 leagues north of San Jose del Cabo*, U.S.N.M.; *San Antonio*, Van Denburgh, 1922, p. 558, C.A.S.; *San Evaristo*, Van

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[28] Personal reports from L. M. Klauber that are not backed by specimens seen by the writer, but are considered reliable.

Denburgh, 1922, p. 565, C.A.S.: *San Francisco Island, east coast*, Van Denburgh and Slevin, 1921*b*, p. 397, C.A.S., M.C.Z.; *San Jose del Cabo*, Van Denburgh, 1895, p. 130, U.S.N.M., C.A.S., Stanford; *San Marcos Island, east coast*, Van Denburgh and Slevin, 1921*b*, p. 397, C.A.S.: *San Nicolas Bay*, Van Denburgh, 1922, p. 565, C.A.S.; *San Pedro*, Van Denburgh, 1922, p. 558, C.A.S., A.M.N.H., M.C.Z.: *Santa Anita*, Schmidt, 1922, p. 679, U.S.N.M.; *Santa Cruz Canyon*, C.A.S.; *Santa Margarita Island, west coast*, Schmidt, 1922, p. 679, U.S.N.M., C.A.S.; *Santiago*, U.S.N.M.; *Sierra Laguna Mountain*, Van Denburgh, 1922, p. 558, C.A.S.; *Todos Santos*, idem, p. 558, C.A.S., M.C.Z.; *Triunfo*, Van Denburgh, 1922, p. 558, C.A.S.).

Habitat and habits.—Surprisingly few notes concerning the habitat and habits of this relatively well known and abundant western species have been published. The first was apparently given by Atsatt (1913, p. 40), who collected the subspecies near the northern limit of its known range. She wrote that "at Vallevista, 1,800 feet, one was found in a stubble field * * * On the outskirts of the town of San Jacinto on the road to Beaumont, 1,500 feet, one was found rustling among dead cottonwood leaves. At Reche Canyon, near Colton, during the summer of 1908, several were collected in such habitats as a sandy wash, on a hill sparsely covered with vegetation, and in the dust by the roadside. Record was made of two found in the act of copulation on July 22."

Grinnell and Camp (1917, p. 175) wrote that the Californian specimens inhabit dry, sparsely vegetated, sandy ground, and dusty roadsides. Several short notes were given by Van Denburgh (1922, pp. 559, 563, and 568) for this subspecies in various parts of its range. In regard to his "*V. hyperythra hyperythra*," which he confined largely to the Cape district of Lower California, he wrote as follows: "Mr. Slevin says that this species ranged from sea level to 1,400 feet, and was found to be abundant throughout the lower levels among fallen cacti and numerous brush heaps. The native name is Waco. This little lizard keeps well under cover, seldom coming into the open, and moves along with a short jerky motion a few inches at a time, until becoming alarmed when it makes off at top speed for the dense undergrowth. A pair were found mating at San Pedro the first week in July." In regard to his "*beldingi*" at San Jacinto, Calif., Van Denburgh reported that specimens were found on rocky hillsides and that they were very shy, quickly retreating into their holes when approached. According to the same authority, Mr. Slevin found the supposedly distinct "*espiritensis*" on rocks in the steep canyons of Espiritu Santo Island, where it was very shy. Klauber (1928, p. 4) has given the following note in regard to the occurrence of *hyperythrus* in San Diego County, Calif.: "Moderately rare from the ocean to the mountains, usually in brush."

Two specimens have been collected by the writer at Jamul, near San Diego, Calif., where they were found on a hillside which was covered with moderate brush, grass, and cactus. In this habitat there were numerous open spaces where the adobe soil was exposed and not infrequently rocks were seen. It was noted that the specimens were definitely associated with brush, which serves as a protection, rather than with the rocks or open spaces. Also, their quick, jerky movements were typically those of a species of *Cnemidophorus*.

Enemies.—According to Van Denburgh (1922, p. 508), Mr. Slevin found a specimen of the giant whiptail lizard, *Cnemidophorus maximus*, under a pile of brush, holding in its mouth a *Verticaria* (this species) whose skull had been crushed in its powerful jaws. Also (p. 673) a specimen of the black whip snake, *Masticophis flagellum piceus* was taken in a brush pile just after it had caught a specimen of *hyperythrus*.

Affinities.—The western orange-throated race-runner is very closely related to its subspecies, *danheimae*, *caeruleus*, and *pictus*. All of these forms are suggested by the normal variations of *hyperythrus* and the transition to each is but a step (see fig. 33). Further information in regard to this may be obtained from the discussion given in the summary of the *hyperythrus* group (pp. 246–249).

The problem of the derivation of *hyperythrus* from the existing *Cnemidophorus* stocks, and through this of the derivation of the entire *hyperythrus* group, is not easy. The most probable parent form seems to be *C. sexlineatus perplexus*, which is found east of the Colorado River in Arizona. A more detailed consideration of this problem will be given in the general discussion at the end of this work (pp. 251–260).

CNEMIDOPHORUS HYPERYTHRUS CAERULEUS (Dickerson)

CARMEN ISLAND RACE RUNNER

1919. *Verticaria caerulea* Dickerson, Bull. Amer. Mus. Nat. Hist., vol. 41, p. 472, (type locality, "Carmen Island, Gulf of California, Mexico"; type specimen,[29] U.S.N.M. No. 64251, C. H. Townsend, collector).—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 573.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46, 1922, p. 681.—Nelson, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 68.—Burt, Proc. Biol. Soc. Wash., vol. 42, 1929, p. 154.

Diagnosis.—The Carmen Island race-runner differs from *C. hyperythrus hyperythrus* by the presence of a single middorsal line which has the same intensity and width as the lateral stripes, at least posterior to the point of forking. In addition, the reddish element in the general coloration is intensified, the general ground color is lighter, and the amount of blue in the ventral coloration is, in general, greater. *C. hyperythrus caeruleus* differs from *C. hyperythrus danheimae* in that the dorsal ground color above the upper lateral stripe on each side is not abruptly darker than the ground color between the two lateral stripes. However, the dorsal bands of *caeruleus* are always a trifle darker than the lateral bands. While the dorsal ground color of *caeruleus* is usually reddish or dark reddish brown, that of *danheimae* is usually grayish or blackish brown.

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[29] The type is well preserved, but has several mutilations. Flesh is exposed by an injury just back of the shoulders, the tail is partly broken 22 mm. from its base, and shot marks may be seen in the breast, mesoptychium, and gular region. A ventral incision is present along the left side of the body.

Description.—Snout only moderately pointed; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars usually 3; supraocular granules usually not extending forward past the anterior border of the third supraocular; frontoparietal 1; parietals 3; occipitals in 2 rows, anterior occipitals often 4, posterior occipitals numerous, minute; anterior gulars moderate to large, graded, and usually decidedly larger centrally; posterior gulars small, granulars; scales of mesoptychium often large, these may or may not be largest centrally, often uniform in size; mesoptychials in about 5 transverse rows.

Body elongate; ventral plates in 8 longitudinal and 26–33 transverse rows; dorsal granules small; limbs moderately well developed; brachials 5–7; antebrachials 3–4; brachials more or less continuous with antebrachials at a point of contact; postantebrachium with a few slightly enlarged granules; femorals 5–7; tibials 3–4; femoral pores 13–20; tail relatively fragile, elongate, tapering; caudal plates large, oblique, and with only moderately strong longitudinal keels laterally.

Coloration distinctive, relatively fixed from young to adult; ventral and caudal aspect similar to *hyperythrus* and *danheimae;* throat usually not orange colored, often suffused with bluish or grayish; under parts usually light blue; tail often obscurely lined laterally, seldom lined dorsally; femur striped or unstriped behind, often unicolor above, and never covered with round spots; back with only one dorsal line, this usually forked only for a short distance anteriorly; lateral stripes 2 on each side, and of the same intensity as the dorsal line; ground color of the body reddish or reddish brown, not grayish or blackish, and seldom even moderately dark brown; ground color of back and sides in general lighter than that of *hyperythrus*, the upper and lower bands not sharply contrasted as in *danheimae;* spots absent from all fields.

A total of 91 specimens of this subspecies, including the type, have been examined. The data may be summarized as follows: Body, 41–68 mm.; tail, 124–196; total length, 165–259; length of tail as percentage of total length, 72–77; width of head, 6–10; width of head as percentage of body length, 11.6–17.6; hind leg, 30–47; length of hind leg as percentage of body length, 51.0–80.5; supraoculars, 3 in 86 specimens, 3–4 in 2 specimens, and 4 in 3 specimens; supraocular granules extending forward to the middle of the third supraocular in 35 specimens, to the anterior border of the third supraocular in 46 specimens, to the middle of the second supraocular in 8 specimens, and to the anterior border of the second supraocular in 1 specimen. The forking of the single dorsal stripe varies from 2.3 to 32.6 per cent of its total length, including the fork. Although a much greater percentage is often found in *hyperythrus*, the forking in this latter species is in some cases almost as short as in *caeruleus* of the lower extreme. Consequently, the extent of forking has practically no diagnostic value in *caeruleus*.

Range.—(*Carmen Island, Gulf of California, Mexico*, Dickerson, 1919, p. 472, U.S.N.M., A.M.N.H., C.A.S., M.C.Z.)

Habitat and habits.—Nothing is known concerning the habits of this subspecies. Carmen Island is small (only 17 miles long and less than 6 miles wide), volcanic in origin, and irregular in outline.

Affinities.—This little lizard is very closely allied to the mainland *hyperythrus*. Transition from the latter toward *caeruleus* may be seen in certain mainland specimens which show a low percentage of anterior forking in a single middorsal stripe. In these the unforked portion of this line is intensified and widened in such a way as to very significantly approach the condition found in both *caeruleus* and *danheimae*. Further approach to *caeruleus* may be seen in certain mainland specimens which possess a more or less pronounced reddish element in the general ground color. Thus *caeruleus* seems to be a direct derivative of *hyperythrus*, and, if so, it is only indirectly related to *danheimae*. In view of this we may consider that the widened and intensified dorsal stripe of *caeruleus* was probably developed in the same manner and from the same common ancestral stock (*hyperythrus*) as was that of *danheimae*.

CNEMIDOPHORUS HYPERYTHRUS PICTUS (Van Denburgh and Slevin)

MONSERRATE ISLAND RACE RUNNER

1921. *Verticaria picta* Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 11, p. 98 (type locality, "Monserrate Island, Gulf of California, Mexico"; type specimen,[30] C.A.S. No. 49155, J. R. Slevin, collector).—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 575.—Schmidt.

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[30] Since the type was not described in detail in the original diagnosis of this species, it seems best to take this opportunity to present some additional facts concerning it. A short description follows: Head scutellation normal for the subspecies; frontal entire; parietals 3; occipitals small and irregular; supraoculars 3; supraocular granules extending as far forward as the center of the third supraocular; postmesoptychial granules present on edge of posterior gular fold; femoral pores 18–21. Measurements: Body, 62 mm.; tail, 178; total length, 240; width of head, 8.25; hind leg, 44; anterior border of tympanum to tip of snout, 16; longest toe, 22. The type is excellently preserved.

Bull. Amer. Mus. Nat. Hist., vol. 16, 1922, p. 682.—STEJNEGER and BARBOUR, Check List N.A. Amph. and Rept., ed. 2, 1923, p. 69.—SCLATER, Zool. Rec. for 1922, vol. 59, "Reptilia," 1924, p. 23.—BURT, Proc. Biol. Soc. Wash., vol. 42, 1929, p. 154.

Diagnosis.—The Monserrate Island race-runner differs from all of the other members of the *hyperythrus* group in the absence of longitudinal dorsal stripes and in the fading or loss of the lateral stripes.

Description.—Snout rather blunt; nostril anterior to nasal suture; anterior nasal usually not in contact with second upper labial; supraoculars normally 3; supraocular granules extending from as far forward as the center of the third supraocular to the posterior border of the second supraocular; frontoparietal entire; parietals 3; anterior gulars moderate to large, graded, and decidedly largest centrally; scales of mesoptychium moderate, largest centrally, in 5–6 transverse rows; postmesoptychial granules present on edge of posterior gular fold.

Body elongate; ventral plates in 8 longitudinal and 30–33 transverse rows; dorsal granules small; limbs well developed; brachials 4–6; antebrachials 2–3; brachials continuous with antebrachials at a point of contact; femorals 4–7; tibials 3–4; femoral pores 16–21; tail elongate, tapering, and moderately carinated above; caudal plates large, oblique, keels forming distinct longitudinal lines laterally.

The ventral coloration is similar to that of *C. hyperythrus hyperythrus*, but there is an emphasis on blue laterally. The adults have (young without) a distinct reddish brown band on each side, continued from the antefemoral surface of the hind limb forward to the sides of the head; entire dorsal surface unicolor, grayish or light brown; dorsal stripes wanting; lateral stripes faint or absent; tail bright blue in young, brownish or grayish blue in adults. In certain individuals the stripes are faintly indicated laterally, especially anteriorly. The brick-red lateral longitudinal band is absent in the youngest specimens and apparently develops with age, for in the oldest examples it is very conspicuous.

A summary of data taken on 17 specimens of this species, exclusive of the type, follows: Body, 40–68 mm.; tail, 105–169; total length, 152–231; length of tail as percentage of total length, 71.5–75.0; width of head, 7.0–9.5; width of head as percentage of body length, 14.0–17.5; hind leg, 25–43; length of hind leg as percentage of body length, 57.0–75.4; supraocular granules extending forward to center of the third supraocular in 6 specimens, and to posterior border of second supraocular in 11 specimens.

Range.—*Monserrate Island* (Van Denburgh and Slevin, 1921*a*, p. 98, C.A.S., M.C.Z.).

Habitat and habits.—Unfortunately, information concerning the detailed distribution of *pictus* is not at present available, and apparently nothing is known about its habits. Monserrate is a volcanic island which is only 4 miles long and 2 miles wide. The highest elevation is 734 feet and the surface is very rocky, but on the north side there is a small bight with a short strip of sand beach near its northwestern point.

Affinities.—The Monserrate Island race runner is very closely related to *hyperythrus*, from which it is evidently derived. It differs from this parent form only in the absence of the dorsal longitudinal striping and in the fading or loss of the lateral stripes. As indicated in the discussion of *hyperythrus*, the dorsal stripes are sometimes lost in that form as an abnormality. From this to *pictus* is but a step (see figure 33). Moreover, the geographical location of *pictus* is within but a few miles of the general range of *hyperythrus*. *Pictus* differs from *caeruleus* and *danheimae* in the same way that it does from *hyperythrus*. It is possible, but seems improbable, that *pictus* was derived from *caeruleus*. This point is further elaborated in the summary of the hyperythrus group (p. 246).

CNEMIDOPHORUS HYPERYTHRUS DANHEIMAE Burt

SAN JOSE ISLAND RACE RUNNER

1895. *Verticaria sericea* Van Denburgh, Proc. Calif. Acad. Sci., ser. 2, vol. 5, p. 132 (type locality, "San Jose Island, Gulf of California, Mexico"; type specimen,[31] C.A.S. No. 435).—Cope, Amer. Nat., vol. 30, 1896, p. 1017.—Boulenger, Zool. Rec. for 1895, vol. 32, "Reptillia," 1896, p. 19.—Cope, Ann. Rep. U. S. Nat. Mus. for 1898, 1900, p. 564.—Van Denburgh and Slevin, Proc. Calif. Acad. Sci., ser. 4, vol. 4, 1914, p. 148.—Stejneger and Barbour, Check List N. A. Amph. and Rept., 1917, p. 65.—Dickerson, Bull. Amer. Mus. Nat. Hist., vol. 41, 1919, p. 472.—Schmidt, Bull. Amer. Mus. Nat. Hist., vol. 46. 1922, p. 681.—Van Denburgh, Occas. Pap. Calif. Acad. Sci., vol. 10, 1922, p. 571.—Nelson, Mem. National Acad. Sci., vol. 21, 1922, p. 114.—Stejneger and Barbour, Check List N. A. Amph. and Rept., ed. 2, 1923, p. 69.—Burt, Proc. Biol. Soc. Wash., vol. 42, p. 154.

1906. *Cnemidophorus hyperythrus* (part) Gadow, Proc. Zool. Soc. London, p. 307.

1907. *Cnemidophorus sericeus* Ditmars, Reptile Book, p. 186.

1929. *Cnemidophorus hyperythrus danheimae* Burt, Proc. Biol. Soc. Wash., vol. 42, p. 154 (new name for *C. sericeus* Van Denburgh, 1895, preoccupied by *C. gularis sericeus* Cope, 1892).

Diagnosis.—The San Jose Island race runner differs from *hyperythrus* by having the ground color of the sides very light, pale sepia or reddish gray, and in distinct contrast to the ground color of the back which is dark gray to black. In *hyperythrus* there is usually no sharp contrast between the ground color of the back and sides, although the actual composition of that ground color and its intensity may vary to a great degree in individuals from different parts of the range. Other differences exist. There is, on the whole, more blue in the ventral and caudal coloration of *danheimae*. Furthermore, the dorsal stripes of the latter have the same intensity and width as those of the sides, while the dorsal stripes of *hyperythrus* have less intensity and width than those of the sides.

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[31] The type specimen of this species was destroyed by the great San Francisco fire of April, 1906.

Description.—Snout only moderately pointed; nostril anterior to nasal suture; anterior nasal not in contact with second upper labial; supraoculars 3–4; position of supraocular granules variable; frontoparietal 1; parietals 3; occipitals usually in 2 rows, anterior largest; anterior gulars moderate to large, graded, and usually decidedly larger centrally; posterior gulars small, granular; scales of mesoptychium often large, these may or may not be largest centrally, sometimes uniform in size, usually in 4–6 transverse rows.

Body elongate; ventral plates in 8 longitudinal and 28–34 transverse rows; dorsal granules small; limbs moderately well developed, often rather weak in appearance; brachials 5–7; antebrachials 3–4; brachials more or less continuous with antebrachials at a point of contact; postantebrachium with a few enlarged granules, but without scutes or polygones; femorals 5–6; tibials 3–4; femoral pores, 13–18 on each thigh; tail relatively fragile, elongate, tapering; caudal plates large, oblique, and with only moderately strong longitudinal lateral keels.

Coloration distinctive, relatively fixed from young to adult; ventral and caudal aspect similar to that of *hyperythrus* and *caeruleus*; throat usually not orange-colored, often suffused with blue or grayish; under parts usually bluish; tail usually lined laterally, and sometimes dorsally; femur usually distinctly striped behind, unicolor or obscurely reticulated above; back with only one dorsal line, this usually forked for about a short distance anteriorly; lateral stripes, 2 on each side, and of the same intensity as the dorsal line; ground color of lower field, between the two lateral stripes on each side, pale sepia or reddish gray; ground color of dorsal fields in sharp contrast to the ground color of the lower fields, darker, and usually dark grayish or black in tonality; spots absent from all fields.

A series of 31 specimens of this small race-runner has been available for examination, and the data secured from them have been summarized as follows: Body, 45–65 mm.; tail, 131–193; total length, 176–258; length of tail as percentage of total length, 72.3–77.0; width of head, 6–10; width of head as percentage of body length, 12.3–17.4; hind leg, 32–45; length of hind leg as percentage of body length, 64.6–84.0; supraoculars, 3 in 22 specimens, 3–4 in 2 specimens, and 4 in 7 specimens; supraocular granules extending forward to the center of the third supraocular in 20 specimens, to the anterior border of the third supraocular in 6 specimens, and to the center of the second supraocular in 5 specimens. The forking of the dorsal stripe varies from 4.5 to 35.4 per cent of its length, including the fork.

Range.—San Jose Island, Gulf of California, Mexico (Van Denburgh, 1895*a*, p. 132, C.A.S., M.C.Z.).

Habitat and habits.—Nothing has been recorded on the habits of this species. San Jose Island is nearly 17 miles long and from 2 to 6 miles wide. It is covered in most parts by vegetation, especially on the high land and in the numerous deep arroyos of its northeastern portion. In general, its surface is a succession of high rocky bluffs, with a few intervening sandy beaches.

Affinities.—This little-known lizard is most closely allied to *C. hyperythrus hyperythrus*, from which it has apparently been derived in geologically recent times. The transition from *hyperythrus* to *danheimae* may be seen in certain mainland specimens of *hyperythrus* that have a low percentage of forking of the anterior portion of a single median dorsal line. In certain of these the unforked portion of this line is intensified and widened in such a way as to very significantly approach the condition found in *danheimae* and *caeruleus*. The race-runners of San Francisco Island are geographically intermediate between *danheimae* and *hyperythrus*, but are nearer to the latter in characters, although certain of the specimens approach the former by a progressive differential coloration of the sides and back and by the intensification and widening of the dorsal stripe. Therefore, there is really no great break between the two extremes, *hyperythrus* and *danheimae*.

SUMMARY OF THE HYPERYTHRUS GROUP

The *hyperythrus* group is confined to the general Lower Californian region. The resemblances among the various forms of this homogeneous natural unit greatly outweigh the differences, for throughout the series there is a remarkable uniformity in the general appearance of the body as well as in most other structural features. All of the forms are relatively small, seldom exceeding a length of over 80 millimeters, and the limbs and tail are slender and weak, giving a general impression of fragility.

The *hyperythrus* group is composed of four forms, a mainland prototype, *hyperythrus*, and three island derivatives, *caeruleus*, *pictus*, and *danheimae*. Since a consideration of the group as a whole, and hence of the prototypic *hyperythrus*, is to be given in the general summary at the end of this work, the present discussion will be limited to the origin and relationships of the three derivatives.

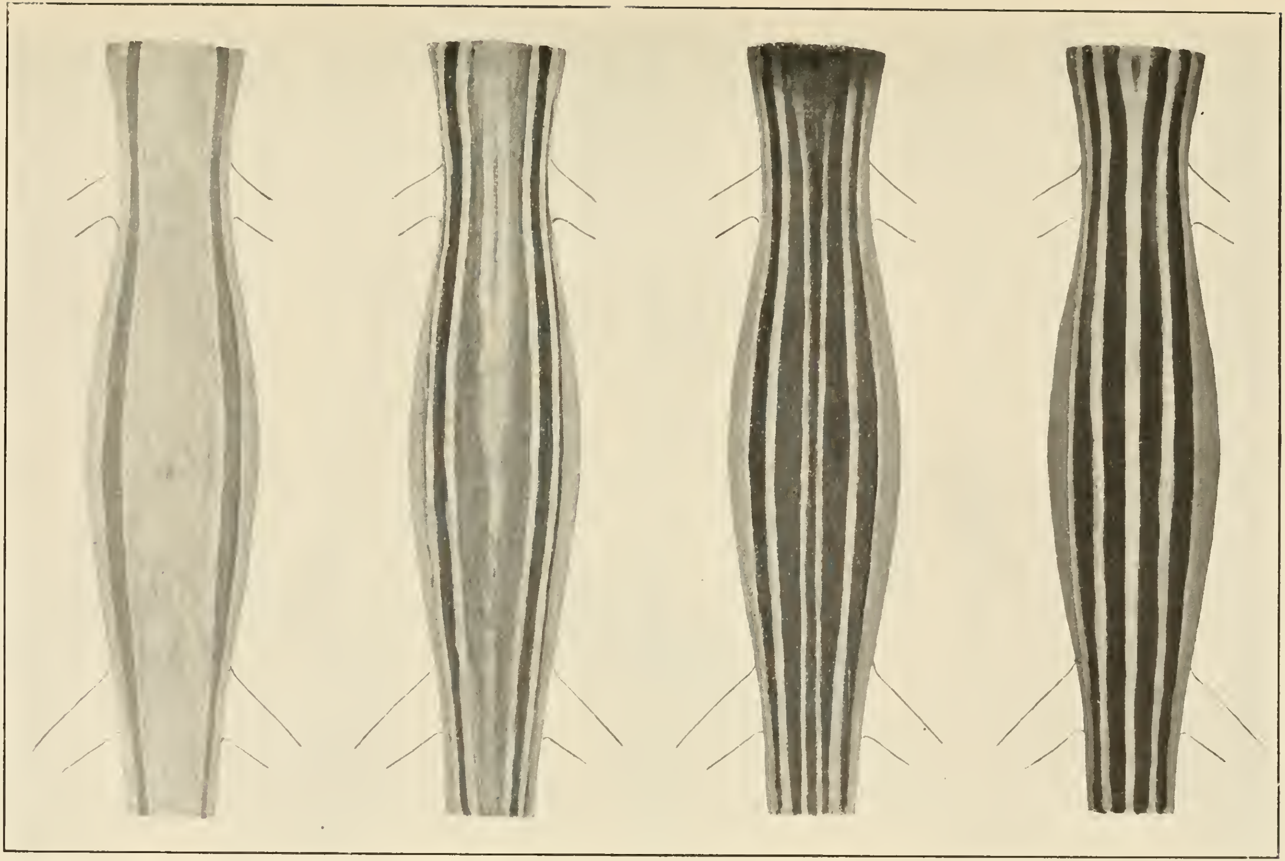

FIGURE 33.—COLOR VARIATION IN THE HYPERYTHRUS GROUP. LEFT TO RIGHT: C. HYPERYTHRUS PICTUS (YOUNG). C. HYPERYTHRUS HYPERYTHRUS (WITH VANISHING DORSAL STRIPES), C. HYPERYTHRUS HYPERYTHRUS (TYPICAL), C. HYPERYTHRUS DANHEIMAE (SAME TYPE AS CAERULEUS). NOTE THE ORDERLY MANNER OF TRANSITION FROM ONE EXTREME TO THE OTHER

The three forms of the group which occur on islands in the Gulf of California (*caeruleus*, *pictus*, and *danheimae*) are clearly direct derivatives from a common ancestral stock which was much like the modern *hyperythrus*. Very shallow soundings (usually much less than 60 fathoms or 360 feet) show that the close lying islands (Carmen, Monserrate, and San Jose) upon which these variants are found are a part of the Lower Californian land mass, so there can be no doubt of the comparatively recent isolation of these small geographical areas. Both Nelson (1922) and Schmidt (1922) have given comprehensive reviews of the available geological data for Lower California. The Miocene age was presumably one of great igneous activity and following this period the general land surface of much of Lower California has been very irregular. The available evidence indicates an extensive submergence of this area during the post-Pliocene period. This is held to have isolated the Cape District from the northern section of Lower California. If the *hyperythrus* stock had populated the peninsula previous to this submergence, it might be expected that a Cape race would have been differentiated during this period of isolation. (See remarks concerning the origin of *maximus*, p. 221.) But, since *hyperythrus*

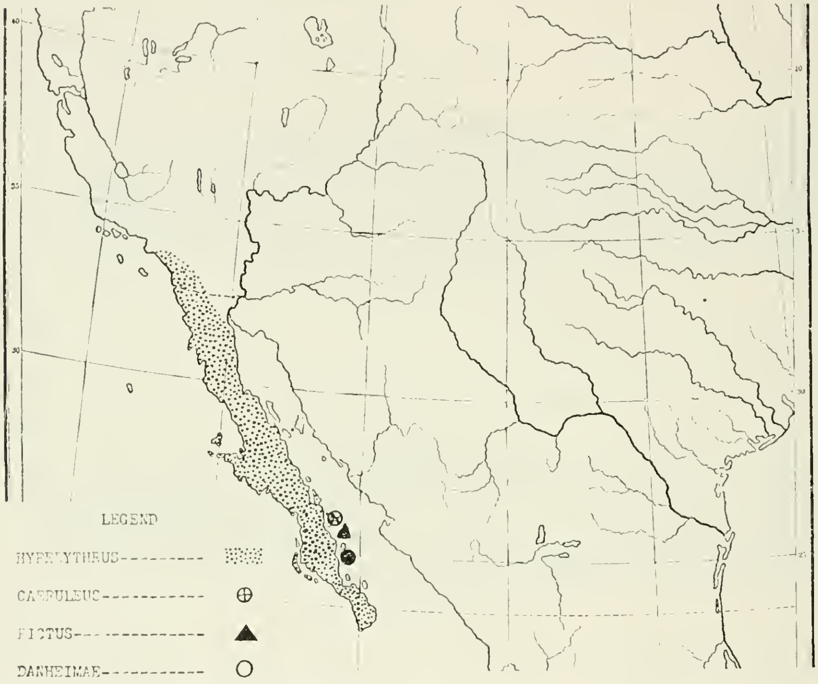

FIGURE 34.—MAP SHOWING DISTRIBUTION OF THE FORMS OF THE HYPERYTHRUS GROUP

occurs undifferentiated throughout the peninsular area of Lower California, it seems reasonable to conclude that it has become distributed over this area subsequent to the post-Pliocene submergence. Therefore, the present island races of *hyperythrus* may be assumed to have been isolated during the most recent submergence (late Pleistocene).

There is some question as to the origin of *pictus*. Whether it was partly derived from *caeruleus* or entirely derived from *hyperythrus* is uncertain, since the dorsal striping is entirely obscured in *pictus* and since the diagnoses of both of the possible parent forms rests chiefly on this character. Data secured from the records of soundings and the geographical location with respect to each both tend to favor the derivation of *pictus* from *hyperythrus*.

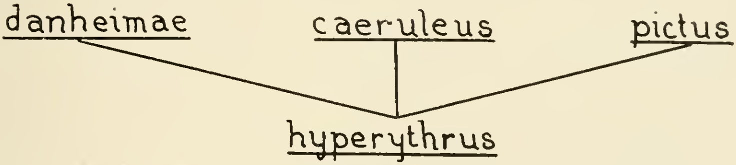

FIGURE 35.—DIAGRAM OF THE SUPPOSED RELATIONSHIPS OF THE HYPERYTHRUS GROUP

The writer's interpretations of the genetic relationships of the forms of the *hyperythrus* group are expressed by the foregoing diagram.

SPECIES OF UNCERTAIN TAXONOMIC POSITION

Only one described form of *Cnemidophorus* has not been available for examination, and unfortunately the published data are insufficient to allow a determination of its true taxonomic position.

CNEMIDOPHORUS SACKII Wiegmann

1834. *Cnemidophorus sackii* WIEGMANN, Herpetologia Mexicana, p. 28 (type locality, "Mexico"; type specimen in Berlin Museum).—GRAY, Cat. Liz. British Mus., 1845, p. 22.—COPE, Proc. Acad. Nat. Sci. Phila., 1866, p. 125.—PETERS, Monatsber. Berl. Akad. Wissensch., 1869, p. 63.—GÜNTHER, Zool. Rec. for 1869, vol. 6, 1870, p. 111.—SUMICHRAST, La Naturaleza, ser. 1, vol. 6, 1884, p. 39.—DUGES, La Naturaleza, ser. 2, vol. 2, 1897, p. 480.

1856. *Cnemidophorus sexlineatus sackii* LICHTENSTEIN, Nomenclator Berol., p. 13, (part).

1862. *Ameiva sackii* COPE, Proc. Acad. Nat. Sci. Phila., p. 63.

1874. *Cnemidophorus sexlineatus sackii* BOCOURT, Miss. sci. Mex. et Amer. cent., vol. 3, p. 276, pl. 20*c*, figs. 6, 6*a–c*.

Systematic Notes.—Because of its importance, in the absence of a specimen, the original Latin diagnosis given for this species by Wiegmann (1834) may be quoted as follows: "Squamis gulae subaequalibus, parvis, oblongis; squamis mesoptychii mediocribus imbricatis; supra virescens, ad latera fasciis transversis nigrofuscis vittisque duabus pallidis variegatis." An English translation of this diagnosis may be given thus: "Gular scales subequal, small, elongate; mesoptychial scales moderate, imbricate; greenish above; variegated at the sides with transverse blackish bands and with two pale stripes."

The original diagnosis was elaborated with the following descriptive paragraph: "Latera dilute fusco-olivacea vittaque longitudinali pallida utrinque marginata, fasciis permultis transversis e fusco nigricantibus variantur. Vittarum lateralium altera pone occiput juxta dorsum excurrens in caudae origine desinit, altera illique parallela prope scuta suborbitalia incipiens et in inio latere continuata ante femora evanescit." In English, this reads as follows: "The sides, pale olive blackish, and bordered laterally with a pale longitudinal stripe, are varied by very many transverse bands, dusky to blackish. Of the lateral stripes, one, extending back of the occiput close to the back, ends at the base of the tail, and the other, parallel to it, beginning near the suborbital scales and continuing on the side disappears in front of the femur."

From the diagnosis and description it is seen that *sackii* belongs either to the *sexlineatus* group or to the *tessellatus* group, both of which have representatives in Mexico. Moreover, it is evident that the prominent barring on the sides excludes the possibility of identity with any of the Mexican species but *gularis*, *perplexus*, and *tessellatus*. Further discrimination is difficult.

It will be noted that nothing is said concerning the ventral coloration. A blue-black color would exclude the possibility of identity with *perplexus* or *tessellatus*, and a coal black color (if not due to fading) would signify the latter form. Likewise, the character of the postantebrachial scutellation is not mentioned. The presence of enlarged scutes would signify *gularis* or *perplexus*, but their absence would not be diagnostic. Also, measurements are not given. If the type is small and the sides are reticulated, it is fairly certain that it is *tessellatus*, but if it is large, this is no criterion.

With this indefinite background it is not suprising that later writers have not been agreed as to the identity of *sackii*. In 1856, Lichtenstein reported it not only from Mexico, but from Montevideo in Uruguay as well. The latter report is certainly not based on a specimen of *Cnemidophorus*. Bocourt (1874) assigned specimens from Oaxaca to *sackii* and since *perplexus* and *tessellatus* are absent from the region, it is fairly certain that these were *gularis*. The same may be said of the records presented by Sumichrast (1884, p. 39) who obtained examples from the states of Oaxaca and Vera Cruz.

However, Peters, Boulenger and Günther all regarded *sackii* as a synonym of *tessellatus*, and Gadow (1906, p. 375) wrote that "Peters has remarked that *C. tigris* (= *tessellatus*) B. & G. is 'undoubtedly' *C. sackii* Wiegm., Herp. Mex., 1834, p. 29. I have been able to corroborate this, by the examination of the type specimen in the Berlin Museum. This synonymy does not apply to *C. sexlineatus sackii* Wiegm., as determined by Bocourt for three specimens collected by Sallé at Oaxaca."

Since Gadow saw very few specimens of *tessellatus* and did not mention his criterion for making the identification, it is thought best to question even his report until it is confirmed by a careful re-examination of the type specimen. If the type is *tessellatus*, *sackii* must be relegated to the synonymy of that form, but if it is either *perplexus* or *gularis*, it will have priority, and one of these will become a synonym of *sackii*.

GENERAL DISCUSSION OF RELATIONSHIPS

It has been shown that the 25 species and subspecies of *Cnemidophorus* discussed in the preceding pages fall naturally into five groups, as diagnosed on page 20. The origin and affinities of the forms within each group have been considered in the respective summaries and it is not the purpose of this discussion to repeat all of this information here. Rather, it is intended to consider the relationship of the five groups of *Cnemidophorus* to one another, or, in other words, to trace their course of evolution, and to show the relationship of the genus *Cnemidophorus* to the other genera of the family Teiidae.

Before discussing the relationships of the various groups of *Cnemidophorus* it seems best to consider the phylogenetic position of the genus. As shown elsewhere (p. 11), *Cnemidophorus* is very closely allied to *Ameiva*. All of the positive evidence at hand seems to indicate that *Ameiva* is ancestral to *Cnemidophorus*. The latter genus differs from *Ameiva* chiefly in the loss of a lingual sheath and in the universal posterior bifurcation of the scaly portion of the tongue. Although the general evolutionary advance of *Cnemidophorus* over *Ameiva* is maintained and exhibited by many other teiid genera, none of these could have been ancestral to *Cnemidophorus* on account of their universal possession of one or more marked specializations, such as a strong transverse compression of the teeth (*Dicrodon*), the loss of digits (*Teius*, *Bachia*, etc.), the possession of noticeably weakened or vestigial limbs and a general serpentine form (*Ophiognomon*, *Scolecosaurus*, etc.), the loss of eyelids (*Gymnophthalmus*, etc.), the loss of ear openings (*Heterodactylus*, etc.), the separation of the prefrontals (*Calliscincopus*, etc.), the complete loss of the prefrontals (*Proctoporus*, *Pholidobolus*, etc.) or of the frontonasal (*Ophiognomon*), enlargement of the dorsal granules into regular series of polygons or scutes (*Anadia*, *Euspon-*

dylus, *Iphisa*, etc.), the acquiring of keeled ventral plates (*Kentropyx*, *Leposoma*), and the assumption of an unusually small maximum size (*Micrablepharis*, etc.). For obvious reasons, these genera are to be regarded as the specialized Teiidae. The remaining genera, which we may speak of collectively as the lower Teiidae, possess longitudinally compressed or conical teeth, five digits, well developed limbs, normal lizard-like form, eyelids, ear openings, large prefrontals, and small dorsal scales, large and smooth ventral scutes and either a moderate or a large maximum size.

Of these lower teiids, two distinct groups are evident: (1) Those with the tail essentially bicarinate superiorly, and (2) those with a normal rounded or cyclo-tetragonal tail. The first group, evidently an ancient branch of semiaquatic habits, is composed of *Dracaena*, *Neusticurus*, *Echinosaura*, and *Crocodilurus*. The second group, presumably the one that has given rise to the specialized Teiidae, is composed of *Callopistes*, *Tupinambis* and *Ameiva*. *Callopistes* has a high number of longitudinal series of ventral plates and attains a large maximum size like *Tupinambis*, but is specialized by the breaking up of many of the large head shields, particularly the anterior ones, and by the assumption of an arrow-headed shape to the tongue. *Tupinambis* shows little specialization and may be described as a large, overgrown *Ameiva*, which differs merely in the constant possession of a higher number of longitudinal series of ventral plates, a characteristic exhibited by the remaining member of Group I, *Callopistes*, and by the least specialized genera of Group II, *Dracaena* and *Crocodilurus*. Unlike *Tupinambis*, the three last-mentioned genera show other notable variations from *Ameiva* and this, in turn, suggests a more remote relationship. It is *Tupinambis*, then, that has apparently given rise to *Ameiva* and the more specialized Teiidae. In support of this view, there is some evidence in the fossil record which indicates that the *Tupinambis-Ameiva* stock is very ancient, and therefore presumably primitive. Camp, a leading authority on the classification of the lizards, has written (1923, p. 316) that "Ambrosetti (1897) and Rovereto (1914) have examined remains of large teiids, close to the living *Tupinambis*, from Oligocene and Pliocene localities in Argentina. The systematic determinations are quite convincing.[32] In addition, the absence of *Cnemidophorus* and the specialized Teiidae from the Greater Antilles on the one hand, and the wide-spread presence of *Ameiva* there on the other, seems to argue in itself in favor of the earlier origin of the latter form and its progenitors. Therefore, because of its close relationship to *Ameiva*, *Cnemidophorus* occupies an intermediate position in the family Teiidae, somewhere between the obviously specialized genera on the one hand and the more generalized, including *Ameiva*, on the other. This relationship is expressed in the diagram, Figure 36.

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[32] Although Williston (1925) listed the extinct North American *Chamops* as a teiid genus, Camp (1923, p. 316) assigned it to the Iguanidae.

The particular problems of the present study are those concerning the evolutionary relationships within the genus *Cnemidophorus*. This genus comprises five distinct groups of related forms, called in this work the *lemniscatus*, *deppii*, *sexlineatus*, *tessellatus*, and *hyperythrus* groups. Only one of these, the *lemniscatus* group, is closely related to the ancestral genus *Ameiva*, and of this group, but one form, *murinus*, shows a close relationship to an *Ameiva* (*A. ameiva ameiva*). This relationship is shown in *murinus* (as compared with other *Cnemidophori*) in the greater number of longitudinal rows of ventral and caudal plates, in the smaller size of the brachials, in the presence of a patch of enlarged postbrachials, in the possession of five parietal shields, in the retention of a vestigial sheath between the larnyx and the posterior tips of the scaly portion of the tongue, in the opening of the nostril between the anterior and posterior nasal shields, and in the similarity of the spotted pattern of the adults. All of these are variations or condi-

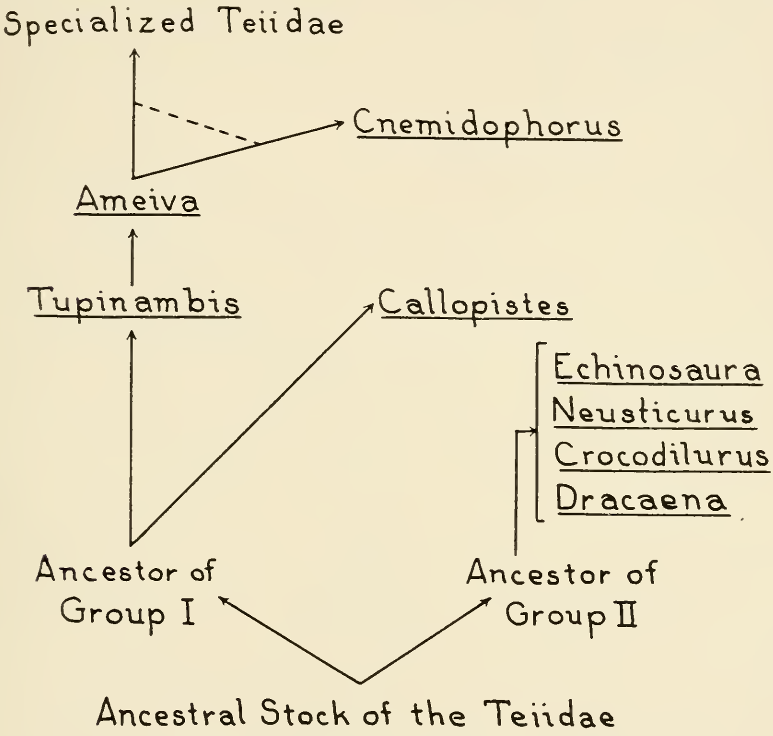
Specialized Teiidae
Cnemidophorus
Ameiva
Tupinambis
Callopistes
Echinosaura
Neusticurus
Crocodilurus
Dracaena
Ancestor of Group I
Ancestor of Group II
Ancestral Stock of the Teiidae

FIGURE 36.—DIAGRAM OF THE SUPPOSED RELATIONSHIPS OF THE PRIMITIVE TEIIDAE

tions that are identical with or tending towards those found in *Ameiva ameiva ameiva.* This bears significance in view of the fact that some of these characteristics are not found elsewhere in the *lemniscatus* group and most of them do not appear in the remaining forms of the genus *Cnemidophorus.*

That there are probably missing links between *Cnemidophorus murinus murinus* and *Ameiva ameiva ameiva*, and hence between the genus *Cnemidophorus* and the genus *Ameiva*, is indicated by the fact that *murinus* presents a number of noticeable variations from *Ameiva ameiva ameiva*, such as a smaller maximum size, a higher average number of femoral pores, a reduced lingual sheath, a heart-shaped scaly portion of the tongue, and the development of anal spurs. Although some of these modifications have been subsequently

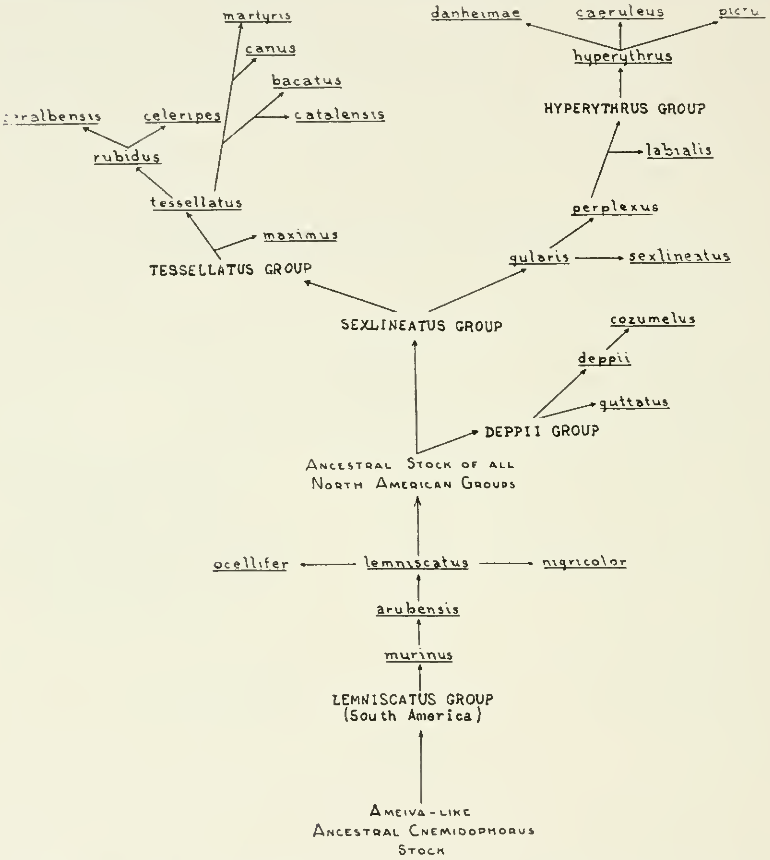
martyris
canus
bacatus
ceralbensis
celeripes
catalensis
rubidus
tessellatus
maximus
TESSELLATUS GROUP
danheimae
caeruleus
pictu
hyperythrus
HYPERYTHRUS GROUP
labialis
perplexus
gularis
sexlineatus
SEXLINEATUS GROUP
cozumelus
deppii
guttatus
DEPPII GROUP
Ancestral Stock of all North American Groups
ocellifer
lemniscatus
nigricolor
arubensis
murinus
LEMNISCATUS GROUP (South America)
Ameiva-like Ancestral Cnemidophorus Stock

FIGURE 37.—DIAGRAM OF THE SUPPOSED RELATIONSHIPS WITHIN THE GENUS CNEMIDOPHORUS. GROUP NAMES, PLACES AT THE POINT OF PROBABLE ORIGIN, ARE IN CAPITAL LETTERS AND SPECIFIC NAMES, PLACED ACCORDING TO THEIR MODERN POSITION, ARE UNDERLINED. ARROWS INDICATE THE DIRECTION OF PHYLOGENETIC DEVELOPMENTS

lost in *Cnemidophorus*, others have been further developed. Here, as in the resemblances, the transition is gradual in most cases, so no great gap or break between the two genera, or between *murinus* and the other species of *Cnemidophorus* really exists.

As the preceding discussion indicates, *Cnemidophorus* is a specialized northern offshoot from *Ameiva*, through an ancestral form similar, at least, to the modern *murinus*. This last-mentioned entity apparently owes its preservation, as does many another primitive species, to its island isolation. To-day *murinus* occurs only on the islands of Bonaire and Curaçao, north of Venezuela. Between these and the mainland—on the small island of Aruba—the closely related *C. murinus arubensis* now occurs. On the mainland we find *C. lemniscatus lemniscatus*, another link in the genetic chain and an obvious derivative of *arubensis*. It is the *lemniscatus* stock, rather than that of the more ancient *murinus*, that appears to be the most progressive element of its group. In fact, *lemniscatus*-like stock, similar, at least in most respects, to the modern *lemniscatus*, was clearly ancestral to all of the remaining forms of *Cnemidophorus*. At an early period this stock, after spreading over northern South America, gave rise to a remarkably distinct southern derivative, *C. ocellifer*, which now inhabits parts of Brazil, Bolivia, and Paraguay. However, the closely allied subspecies of *lemniscatus*, *nigricolor*, which now occurs on the coastal islands of the arc extending north of Venezuela and east of Bonaire, no doubt originated in relatively recent times, probably not earlier than the Pleistocene. The details of the relationships within the *lemniscatus* group have been given on pages 53 to 56.

Athough the assignment of definite geologic age to the evolutionary events in the history of *Cnemidophorus* is largely conjecture, the following time relations allow an explanation that seems to fit the facts so far as known. Northward migration of the ancestral *lemniscatus* stock was impossible in the early Miocene, if it existed at that time, because of the presence of an extensive water barrier, the Costa Rican-Panama portal. Later in the Miocene, just after the closure of this portal, certain faunal elements from South America were said to have spread from Central America to the West Indies. *Lemniscatus* may have started on this journey at that time, for it is now found on Old Providence Island, but, if so, it was apparently blocked from further eastward migration since it has not been found on Jamaica or Hispaniola.

As to the origins of the *deppii*, *sexlineatus*, and *tessellatus* groups, there is some uncertainty, but it is very probable that the former appeared first. The species *deppii*, the southernmost representative of its group, shows the least specialization from *lemniscatus* of all the northern *Cnemidophori.* In fact it exhibits a marked similarity to this southern, wide-ranging, plastic form, differing chiefly in the absence of one of the supraocular shields, in the loss of the outer pair of large parietal plates and in the changed position of the nasal opening. It may be remarked here that the last two of these modifications are retained in the remaining groups of *Cnemidophorus*, in which, in addition, other changes have occurred. In *deppii* and *lemniscatus* the distinctive coloration and general bodily size of the young are practically identical and even the adults often resemble each other in many ways.

The *deppii* protostock was probably not evolved before the late Miocene. If it had existed earlier it would probably have spread to the Greater Antillies, but *deppii* has not been found there. In fact, it is even absent from old Providence Island where *lemniscatus* now occurs. After its evolution the ancestral *deppii* stock was apparently divided into two parts by the opening of a marine portal across the Isthmus of Tehuantepec. Of the time of formation of this barrier to the northward migration of southern elements, Schuchert has said (1929, p. 141) that "it was certainly open during early Pliocene time, and probably also during the late Miocene." The southern section of the isolated ancestral *deppii* stock probably gave rise to the modern *deppii*, while the isolated northern section changed to produce the forerunner of the present Mexican *guttatus*. After the closure of the Tehuantepec portal the hardy *deppii* stock again migrated northward. Thus it was brought into the area now occupied by *guttatus*. Apparently in recent geological times, probably in the late Pleistocene, a small portion of the population of *deppii*, isolated on islands off the coast of Quintana Roo, Peninsula of Yucatan, has changed to *cozumelus*, a closely allied subspecies of the former lizard.

Because of the general retention of four supraoculars in the higher groups of *Cnemidophorus*,[33] it is improbable that their progenitor arose from a completely differentiated *deppii* stock. However, because of the dark blue ventral suffusion found in both the modern *gularis* and the modern *deppii* and the possession of other features in common, a mutual origin from a *lemniscatus*-like stock is suggested.

As to the method of derivation of the higher groups of *Cnemidophorus* from this *lemniscatus*-like stock, it is known that the geology of the Central American region has been much varied, and therefore, there was probably ample opportunity for the ancient isolation of a part of the southern *lemniscatus* stock to produce the ancestral population which gave rise to the northern groups, and likewise for the later isolation of portions of this assemblage to allow the further genetic advances that are to be seen in *Cnemidophorus* at the present time.

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[33] It may be noted here that *deppii* itself occasionally retains the original four supraoculars (see p. 60 for details).

It is difficult to surmise the exact geological time at which the differentiation of the *sexlineatus* group from the *lemniscatus* and *deppii* groups occurred, but it probably did not take place before the early Pliocene. Aside from what has already been noted, a more recent evolution (than that of the *deppii* group) for the *sexlineatus* group is suggested by its more northern range. In spite of the fact that the hardy protostock of the *sexlineatus* group, as exemplified by the modern *gularis*, is the only satisfactory hypothetical ancestor of the *tessellatus* and *hyperythrus* groups, the main evolution within the *sexlineatus* group itself has been apparently very recent (Pleistocene). In fact three of the four members of the *sexlineatus* group are now intergrading extensively in the Southwest. These are the central *gularis*, the eastern *sexlineatus*, and *perplexus* of the Sonoran region. The latter has given rise to a unique variant, *labialis*, which now inhabits northern Lower California. This lizard is of considerable importance in explaining the genesis of the *hyperythrus* group as will be revealed later.

The *tessellatus* group is obviously descended from the *sexlineatus* group, from which its scutellation and color pattern may be easily and logically derived. As shown in the summary of the *tessellatus* group, *maximus*, and *tessellatus* retain more primitive characters than any other forms of the section and are, therefore, the only possible prototypes.

In the possession of four supraoculars and in the occasional retention of bluish as a suffusion on the ventral surface of the young, these forms show an affinity with *gularis*, the plastic prototype of the *sexlineatus* group mentioned above, but in the constant presence of small or slightly enlarged granules on the back of the forearm and in the possession of lateral tessellations, cross-bars or irregular stripes in the young they present a decided variation from this spotted racerunner. Although the approach to *gularis* is usually closer in typical *maximus* than in typical *tessellatus*, there is little doubt that both of these forms had a common origin because of their marked resemblances to each other. The transient ancestral population of the two forms may have come from the north at about the same time, in which case both are now the remnant of a common stock, of which *tessellatus*, lying nearer to the point of origin, has proved to be the most progressive element.

There are nine forms in the tessellatus group, *maximus*, *tessellatus*, and seven others. Only one of the latter, *rubidus*, occurs on the mainland. Its slight colorational differentiation from *tessellatus* and its absence from the more distant islands both suggest a comparatively recent derivation, and this may be assumed to have taken place during the Pleistocene age some time prior to the last extensive submergence of the Lower California region.

The remaining six forms of the *tessellatus* group occur exclusively on islands in the Gulf of California and all are clearly recent derivatives from *tessellatus* and *rubidus*. The two derivatives from *rubidus* are *ceralbensis* of Ceralbo Island and *celeripes* of San Jose Island. The four remaining insular forms, *canus* of Sal Si Puedes and the San Lorenzo Islands, *martyris* of San Pedro Martir Island, *bacatus* of San Pedro Nolasco Island and *catalinensis* of Santa Catalina Island, are all dwarf derivatives from *tessellatus*, presenting a common variation, the loss of the longitudinal arrangement in the dorsal markings, which is so characteristically evident in typical *tessellatus*, and the development of a tendency to possess a finely reticulated or finely spotted color pattern.

The *hyperythrus* group is unique in the normal possession of one frontoparietal plate instead of two. It is also characterized by the retention of a striped pattern throughout life and by the unstable character of the dorsal lines. It has been shown that *labialis*, the most specialized member of the *sexlineatus* group, which occurs in northern Lower California in the same general range as *hyperythrus*, the prototype of the *hyperythrus* group, also retains the striped pattern throughout life and shows a similar variation of the dorsal lines. However, *labialis* exhibits a number of modifications which depart as much from normal *hyperythrus* as from normal *perplexus*, its ancestor in the *sexlineatus* group, and these are, of course, of little importance in determining relationships. Otherwise *labialis* differs from *hyperythrus* chiefly in the presence of two frontoparietal plates instead of one. Therefore, it appears that *labialis* shows transition from *perplexus* of the *sexlineatus* group to *hyperythrus* of the *hyperythrus* group, having become specialized somewhat in the direction of the latter, only to have its characters fixed, probably through the agency of isolation, before the union of the frontoparietal plates took place. This latter change, probably occurring no earlier than the middle Pleistocene, no doubt marked the birth of a new section of *Cnemidophorus*, the *hyperythrus* group, this being based at first on a monotype, a species closely resembling, in all probabilities, the present *hyperythrus*.

The *hyperythrus* group is confined to the Lower Californian region and southern California, and is composed of four forms, the prototype, *hyperthrus*, and three insular derivatives, *caeruleus*, *danheimae*, and *pictus*, all of which are very closely allied to the parent form.

An outline of the apparent evolution of *Cnemidophorus* (accomplished through a series of phylogenetic changes by no means clear at all points), with reference to geological time, is given below. The geological data upon which these conclusions are essentially based were summarized by Schuchert (1929).

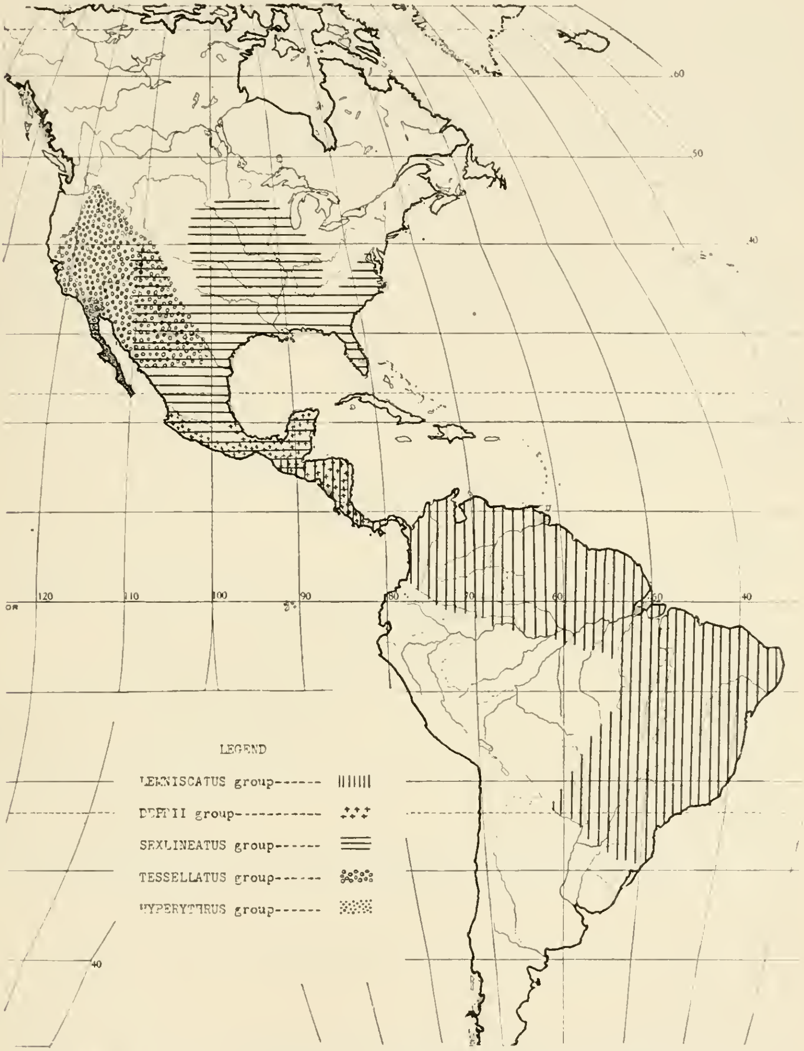
60
50
40
120
110
100
90
80
70
60
50
40
0
40
LEGEND
LEMNISCATUS group------
DEPPII group-----------
SEXLINEATUS group------
TESSELLATUS group------
HYPERYTHRUS group------

Figure 38.—Map showing distribution of the five groups of the genus Cnemidophorus. Note the distinctive range occupied by each

1*a*. Early Miocene: *Cnemidophorus* not differentiated from *Ameiva*.

b. Middle Miocene: Development of the protostock of the *lemniscatus* group and its spread over northern South America.

c. Late Miocene: Northward migration; evolution of the protostock of the *deppii* group in Central America.

2. Pliocene: Further northward migration; probable evolution of the protostock of the *sexlineatus* group in southern Mexico.
3. Pleistocene: Continued northward migration; evolution and differentiation of the *tessellatus* and *hyperythrus* groups in the Lower Californian region.
4. Recent: Further migration, evolution and differentiation in progress.

Briefly, then, *Cnemidophorus* had its origin from *Ameiva* in northern South America. This land was its ancient or primary center of dispersal until, with the passing of geological time and in the course of extended northward migrations, a new or secondary center was developed in Mexico. During the time of its spread through Central America into Mexico and the United States, the genus *Cnemidophorus* differentiated into five groups, of which the most primitive, the *lemniscatus* group, is now chiefly South American in range. The two most specialized, the *hyperythrus* and *tessellatus* groups, have reached the extreme ranges for the genus in the northwest. The *deppii* and *sexlineatus* groups are intermediate in range and in characters between the northwestern *hyperythrus* and *tessellatus* groups and the southern *lemniscatus* group, except for the northeastward extension of one form, *sexlineatus*.

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[34] The following list includes, in addition to the literature cited, the more important references given in the synonymy. However, readily accessible, modern titles which are sufficiently cited in the synonymy have often been omitted.

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